Volume 9, No. 1 January, 1954

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...HOWARD W. OTTOSON

Gaining Public Understanding and Support for Conservation and Resource-Use Education
...RICHARD L. WEAVER

Book Reviews: Resources and the American Dream; Water; Plant Diseases; Sixth International Grassland Conference and Others.

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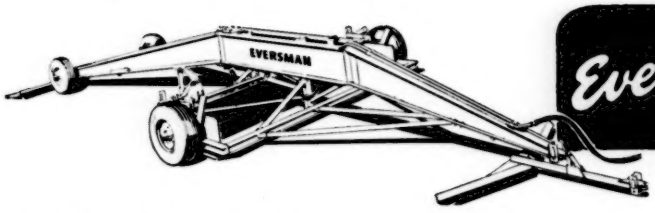

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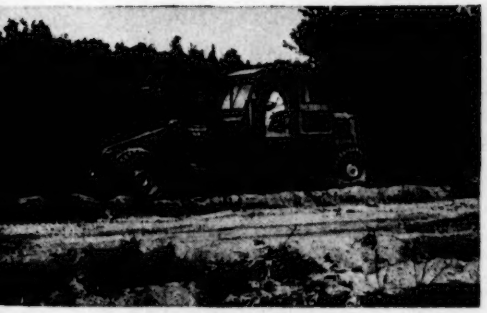

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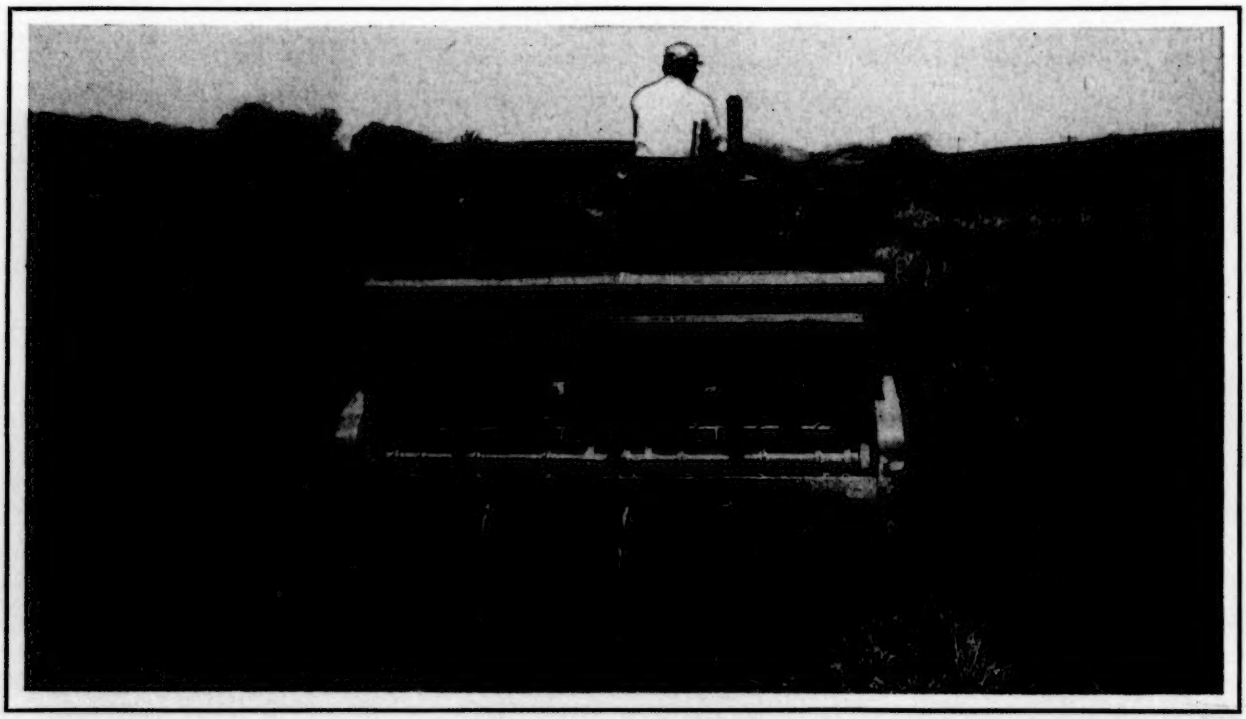

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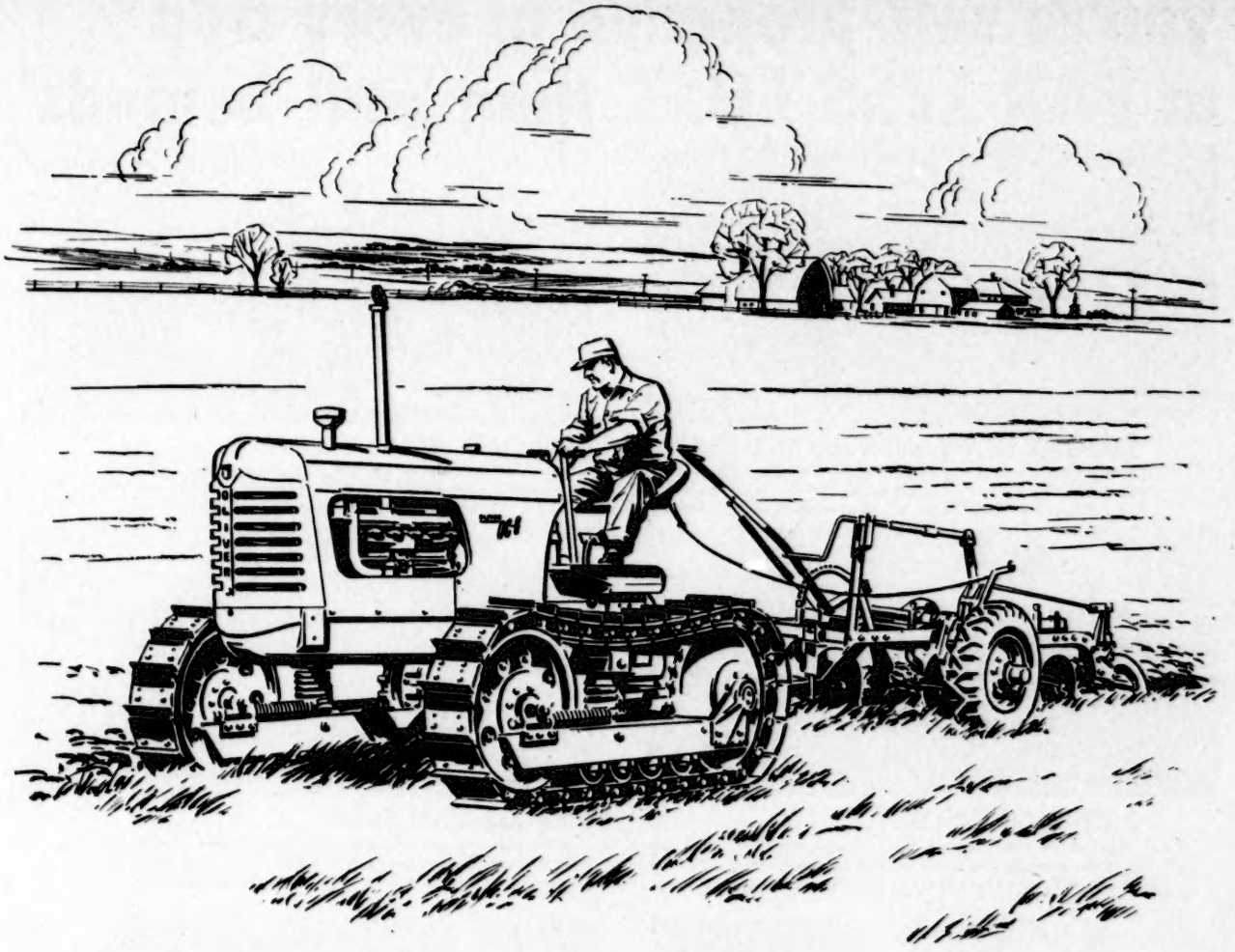

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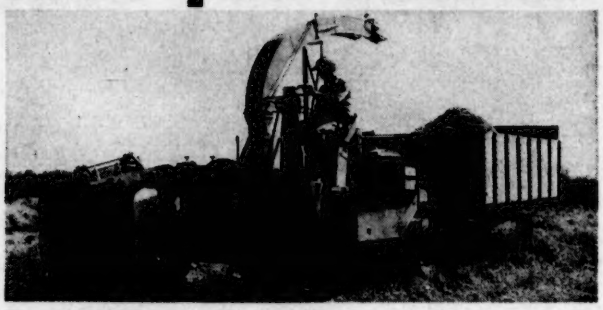

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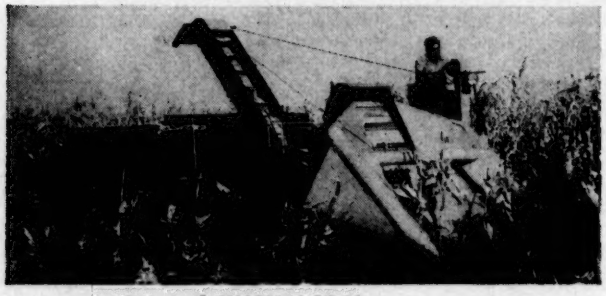

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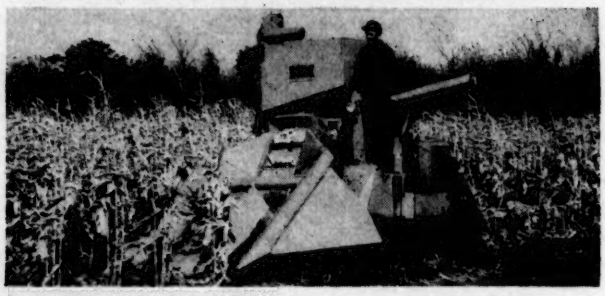

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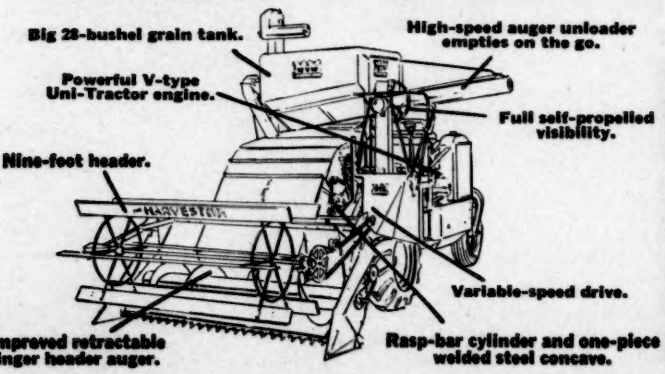
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Journal of SOIL AND WATER CONSERVATION

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Contents for January, 1954

Community and Agency Teamwork in A Montana Valley
HAROLD HAGEN 7

The Requirements of Partnership in Conservation
RAMOND A. MCCONNELL, JR. 11

Soil and Water Conservation in Western Canada
L. B. THOMSON 15

Resources for the Future—Promise or Chimera?
BERNARD FRANK 19

Gaining Public Understanding and Support for Conservation and Resource-Use Education
RICHARD L. WEAVER 22

Immunity On Nature's Terms
J. DAVID LARSON 28

Soil Splash by Raindrop Impact on Bare Soils
BEN OSBORN 33

Does Better Soil Management Pay?
HOWARD W. OTTOSON 39

Young Outdoor Americans Building a Better Outdoor America
GRACE O. BEACH 44

Book Reviews 46

COVER: Trash cover and strip cropping has become one of the accepted answers to wind erosion on the prairies. Taken in Southern Alberta between Taber and Lethbridge this type of scene is now common across the prairies.

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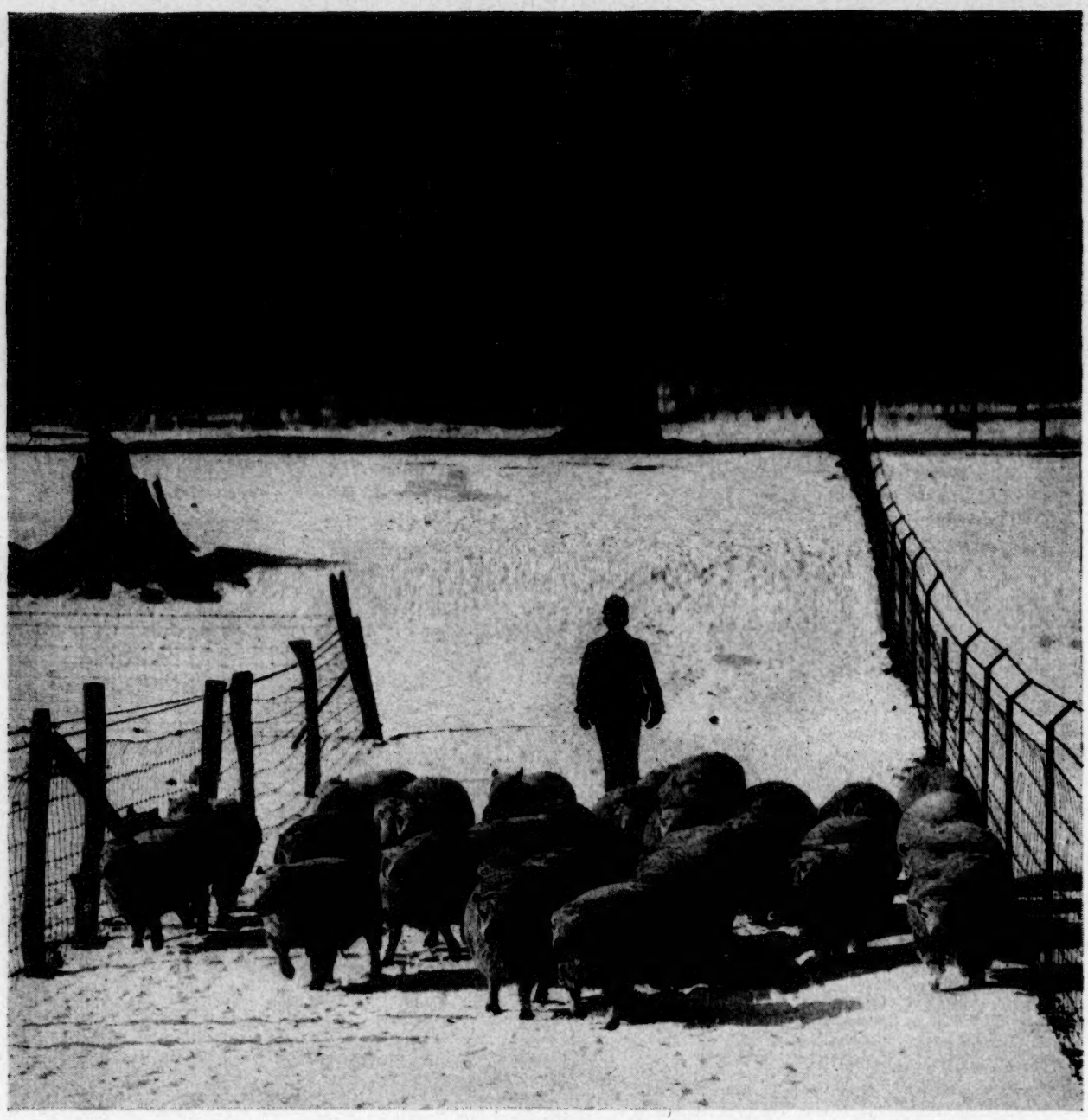

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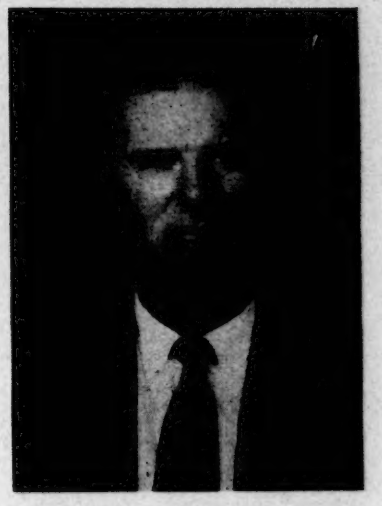
Community and Agency Teamwork in a Montana Valley

HAROLD HAGEN



Harold Hagen

How to marshal and direct the forces of education and how to promote action for maximum conservation results caused Harold Hagen, a soil conservation district supervisor, to accept an invitation to explain a program of community and agency teamwork developed in Ravalli County, Montana at the Eighth Annual Meeting of the SCSA. He feels very strongly that the natural resource situation demands application of more effective approaches to hasten the solution of many problems which vitally affect all phases of our lives.

RAVALLI COUNTY is perhaps the most compact and unified county in Montana, both geographically and in respect to problems of common interest. The heart of the Bitter Root Valley, the scene of this story, is a fertile strip of land along the valley floor, comprising 127,000 acres of irrigable land. The agricultural area is surrounded by a zone of semi-arid foothill land originally covered with sagebrush, grass and scattered patches of timber. The third and outer zone is a horseshoe-shaped rim of mountains clothed with timber in private, State and Federal ownership. This mountain rim helps to further unite the County into a closely knit unit.

There are no through routes of travel by rail transportation to bring industry for producing other sources of revenue. There are only the natural resources, some of which were found in abundance but now have been greatly depleted by extravagant use, misuse and abuse. The welfare of the people of the area, numbering some 13,000, has been in the past and will be in the future, dependent upon the resources of soil and water.

It can be truly said that the future of the Bitter Root Valley lies in the care and use of its natural resources of soil, water, timber, and other products. The blunt facts are that our lands have been mismanaged to the extent that the net income from crops, livestock, timber and other major products is far below what it can and should be. Our experience has amply demonstrated that natural resources cannot be adequately protected or developed by people working as individuals or even by public agencies working independently of each other. The solution of this problem requires intelligent, wholehearted, harmonious understanding and action based on the diverse needs and aspirations of all the people in the area. *The climate within which this problem must be solved presents many challenging aspects. It requires search for ways that will bring decisions back to where they once again challenge the imagination and hopes of all the people directly affected.*

Apathy Toward Resource Problems Is General

We find conservation and agricultural leaders disturbed by the significance of resource problems and the general apathy toward their existence. Organized conservation groups feel that they are lone wolves crying in the wilderness. Specialized conservation associations have zeal in their leadership, but continually speak of community apathy. Few communities actually see their resource problems in the large, or specific ones in relation to each other. People of many communities live in bitter competition and narrow group consciousness. These states of mind exist, not necessarily because they are attractive, but because no one has shown them how rich and full their lives could become through a sense of

Harold Hagen presented this paper at the Eighth Annual Meeting of the SCSA held in Colorado Springs, Colorado, November 7, 1953. Mr. Hagen is the owner and operator of a 600-acre farm located near Stevensville, Montana. He is chairman of the Board of Supervisors of the Bitter Root Soil Conservation District, a member of the Montana Conservation Council, a director of the Montana Reclamation Association and a member of the Agricultural Advisory Council of the Montana State College.

Figure 1.—A group of teachers on a field trip studying soils, grasses and other resource problems and needs.

belonging, and actually participating with, other individuals and groups in improving existing situations. We need only to see the light of satisfaction in the eyes of men and women who have worked together to achieve a common goal and have succeeded, to fully appreciate the value of group and community action.

The situation demands that practical ways be found for organizing creative efforts to unify public will to more effectively advance democratic processes, and at the same time improve local situations. Full and complete appreciation of all circumstances is essential in organizing efforts directed at achieving public understanding and action.

We have reached a place in American agricultural life, especially in view of the trend in turning more responsibility for the functioning of Government back to the people, where the people must acquire not only a better understanding of resources situations, but must exercise rights, obligations and opportunities, as citizens, to contribute to their own development and the welfare of all the people in the community. Conservation leaders must also realize that it is important, in these perilous times, not only to increase citizens' interest and participation in the field of natural resources, but in all public affairs which so vitally affect the strength and welfare of the community. The need for leadership in this field is great. The task is big and complicated. *In spite of the magnitude of these problems the soultion is simply one of getting people interested in searching for facts upon which to base sound judgment and decision. The very problem that each community faces constitutes material out of which a program can be developed for citizenry participation and action.*

Everyone knows that we are inclined to be interested in the things that are closest to us. It is also common knowledge that if we are helped with the problems that disturb us the most, we are almost certain to be receptive and appreciative of possibile solutions. Conservationists must be fully aware of all the opportunities inherent in democratic ideals to permit mobilizing public will in solving unsatisfactory resource situations. Groups must be organized which see the community as a whole, which are as fully representative as possible, which can conscientiously consider the broader community needs, and which will take the necessary steps to mobilize community resources.

Resource Groups Formed to Stimulate Action

A dozen or more different grass-root groups have, during the past decade, held a multitude of local study meetings analyzing local situations. These meetings have been widely attended and participated in by landowners, agency technicians, business and other interests. Committees of farm and ranch people have held numerous meetings and have prepared lists of problems in irrigation, livestock, range, timber, fish and game, and other related fields.

Awareness on the part of the Ravalli County Agricultural Resource Conservation Committee of the material and human factors described led to search for more effective approaches to these problems. The community and agency program developed as a result of this concern. The purpose of this program is to simply bring people and agencies together on a community basis to pool their skills and judgment on problems affecting people in the use, protection, and development of all natural resources.

The country divides into twelve natural community groups. These center around church, school, and trading facilities.

We are not fully satisfied with our total accomplishments, but they have been sufficient to fully test the value of the community approach. A few illustrations will explain how the program functions.

If I am to adequately explain the community and agency teamwork that has been and is existing in the Bitter Root Valley, it is necessary that I tell you of some of the problems which brought this close cooperation into being.

The first settlers in the Valley found the mountain slopes to be covered with one of the finest stands of Ponderosa Pine in America. It has been estimated that about a billion and a half feet of sawtimber has been removed on privately owned land. Practically all of it was clean cut and the land was either allowed to revert back to the county in lieu of taxes or was put to some agricultural use, chiefly grazing.

Several thousand acres of this cut-over land was converted to farms, but since most of the land was shallow and rocky and unsuited to general agriculture, these, too,

Figure 2.—*Left.* The county agricultural agent conducts both method and result demonstrations; also field tours. This group is observing land conditions. *Right.* Another group in the Bitter Root Valley studying erosion control and the location and care of logging roads.

finally reverted to public ownership. This trend toward tax delinquencies was aggravated by an orchard boom which occurred in 1910, doubling the population of the county, but due to unfavorable marketing and growing conditions brought economic distress to many people.

Tax Delinquent Land Was a Basic Problem

The large number of tax delinquent properties, the rapid turnover and diverse use of much of our agricultural land led to an incredible assessment of values for tax purposes. Some of the poorer lands were made to pay taxes far above their ability to produce, while the good lands did not pay their share. In an attempt to correct this situation a joint meeting of the soil conservation district Supervisors and the Board of County Commissioners was held. It was decided to petition the Soil Conservation Service to conduct a soil survey of all the land in the county for the purpose of land use planning as well as to prepare a base for the reclassification of lands for tax purposes.

This request bore fruit in the form of an agreement between the Soil Conservation Service, State Experiment Station, and the United States Bureau of Chemistry and Soils, by which these three agencies would cooperate in completing a basic Soil Survey of the Bitterroot Valley. Field work was begun in 1948 and in 1951 the survey was completed. It provided basic soils information on more than 500 square miles.

During the progress of the survey many meetings were held which were attended by land owners, business people, and agency representatives. As a result there is general approval of the methods used and the results obtained.

A committee is engaged in studying and analyzing the forestry situation. These efforts contemplate a series of group meetings with private timber landowners, the extension forester and other technicians. This group has already been instrumental in acquainting local state legislators with problems which led to the enactment of some legislation. A sound forestry program will be developed as efforts in this field are expanded and carried to their ultimate conclusion.

After several dicussion meetings, a livestock association assumed leadership, with a local forest ranger, in arranging a field trip of a week's duration, with several representatives of livestock, wildlife, State and Federal technicians. As a group they analyzed forest and range conditioons. On-the-ground pooling of opinions and judgment led to a meeting of minds on condition of resources. This will be followed with another series of meetings to agree upon action that will meet the resource requirements.

Achievements Have Been Far-Reaching in Scope

These achievements actually developed from concern in several communities over unsatisfactory land use and management practices. Action stemmed from community leaders who first directed efforts at making facts and information available to all the people concerned. The services of a well-qualified state technician were secured and he conducted a series of well-attended group meetings directed at creating an ecological and natural history approach which had to do, not with statistics in a book, or with somebody's theory, but with working relations of living plants, animals, and man himself, in their natural surroundings, based upon facts derived from research.

This basic knowledge stimulated community leaders to follow through on their own initiative, with another series of meetings for the purpose of analyzing and discussing the various problems involved. These meetings are now being continued into their third year. This accomplishment provides ample proof and evidence that public planning can be achieved if conservation leaders and agency people will give such efforts encouragement and direction. Experience definitely convinces me that we

conservationists are responsible for the people not taking on conscious educational purposes faster than they have. I am certain that as a group we have spent far too much time and effort discussing unsatisfactory resource situations rather than concerning ourselves with methods and techniques for bringing about solutions.

I implied that we are not entirely satisfied with agency progress in organizing the efforts that the Ravalli County Conservation program contemplates. The framework for organizing community action groups is built around the educational and organizational experience of the Extension Service. The County Agent is, therefore, responsible for organizing community groups and integrating, at the appropriate time, the skills and services of other technical agencies. Demands upon his time occasioned by established work priorities beyond his control, prevent him from devoting the desired time to these activities. Evidence indicates that the same situation is likely to occur on the part of other cooperating agencies, unless agency chiefs at State and National levels encourage field forces to direct more time and effort in creating better public understanding of natural resources situations. Public interest and welfare demand that this be done.

Figure 3. This gully was caused by the improper location of a logging road.

Cooperative Approach Is the Only Way

President Eisenhower's conservation message to Congress not only encourages the agency action suggested, but supports the application of methods and techniques proposed in the Ravalli County Resource Conservation program. The message is specific in mentioning the necessity of organizing a cooperative partnership of states, local communities, private citizens and the Federal Government for formulating a sound natural resource conservation program for the Nation as a whole. *A cooperative approach is the only way that those efforts can be achieved.*

Despite past conservation efforts, the forces of depletion of natural resources are still outstripping the forces of replenishment. The President undoubtedly recognized these facts when he stated in his message to Congress that: "*I believe it will be useful to focus attention on some of our basic land and water resource problems and to point the way for constructive efforts to improve the management and use of these resources.*" The situation certainly requires that conservationists employ every influence at their command to contribute to that effort. As a step in that direction, I would suggest that a committee designated by this organization fully investigate the merits of the community-group approach adopted in the Ravalli County Agricultural Resource Conservation Program. If the findings are favorable, I urge that your organization encourage the Secretary of Agriculture and agency chiefs to fully test the application of these methods, at least on a basis of a few widely selected pilot projects.

In conclusion, I wish to emphasize that we need to make full and efficient use of our soils and water, and full use of the labor and genius of the people in all communities, just as much as we need to protect the soil from deterioration. The thought that I am anxious to leave is that *in finding solutions to our national resources and other problems, we need not fear the basic strength and capacity of people to meet any emergency when given the facts, a free hand, and full responsibility in meeting their problems.* These very traits have been responsible for the survival and maintenance of our way of life. They are sufficiently powerful, if applied, to provide the community and agency teamwork necessary to assume development of a sound conservation program.

The Requirements of Partnership in Conservation

RAYMOND A. McCONNELL, JR.

Raymond A. McConnell, Jr.

This address by Raymond McConnell, Jr. before the annual meeting of the Soil Conservation Society of America held in Colorado Springs, was acclaimed by Dr. Hugh H. Bennett as worthy of nation-wide dissemination. In it the author describes his experiences with the Salt-Wahoo Watershed Association of Eastern Nebraska and its implications for a national land and water use policy. As an advocate of local-state-federal partnership in watershed development, Mr. McConnell spelled out what he conceives this to mean in terms of new local cooperative techniques, new state legislation and new national executive and legislative action. The second part of this article dealing with local and state partners and the requirements of the federal partner will appear in the March issue of the Journal.

MY STORY is about a little creek that runs through the city of Lincoln and overflows every so often, with consequences my community is convinced that neither it nor the nation can afford. It is the story of how a community's efforts to control that creek in terms of a total program of soundly planned land and water management for all its tributaries and all the 1,655 square miles of land they drain, so as to give us protection from floods, insurance against drought, and enhanced and stable agricultural production, and a maximum of recreational values, in themselves overflowed into the whole area of national policy governing natural resources development and use.

It is also the story of today's challenge to the pioneering spirit of town and county civic leadership in every part of America, and of the opportunity for imagination and ingenuity in government at every level, local, state and federal. That challenge and opportunity are found in the fact that technical knowledge and skill with respect to soil and moisture conservation and all the related beneficial uses of water and land have far outstripped the application of conservation measures on the basis of the individual farm.

The best of today's thinking views soil and water resources in their many-sided relations to each other; streams in relation to the lands they drain; river control and flood prevention in their relation to proper land management; rural and urban interests in these things with regard to the solutions city dweller and farmer can work out in common; and all the beneficial uses of the total complex of so-called renewable natural resources together. It sees flood prevention and protection against drought — measures to safeguard against the hazards of too much or too little water, as two sides of the same problem of reducing damages from rains of flood producing proportions; and all this one bundle of closely-related problems as demanding a high degree of local initiative, participation and control in their solutions — for very excellent American reasons.

One of the best of these reasons for this emphasis on local participation and initiative is that when you link river control and development with on-the-land conservation practices and proper land use management, you are linking essentially public works with the private lives and livelihoods of several million farmers. You are meshing measures undertaken in a regional or national interest with on-the-farm practices and planning undertaken primarily in a local or private interest and only partly for the greater good. You can gear the two together completely as England did in wartime under the necessities of national survival, by having government tell the farmers how to use their land to best national advantage and displacing them if they don't. Or you can devise ways by which the local people themselves — including the farmer whose wise use of his own land is essential to a balanced and efficient total job — can help shape the pattern and set the pace of their natural resources planning and development. In the latter, or American way, the role of the individual farmer in a related overall resources program remains purely volun-

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Raymond A. McConnell, Jr., presented this paper at the Eighth Annual Meeting of the SCSA held in Colorado Springs, Colorado, November 7, 1953. Mr. McConnell is editor of the Lincoln Evening Journal and the Nebraska State Journal, Lincoln, Nebraska. He is a prime mover and co-chairman of the trail-blazing Salt-Wahoo Watershed Association in eastern Nebraska and the spokesman in 1953 for a group of national watershed leaders at a White House conference which gave principal impetus to initiation of the nation-wide "pilot plant" watershed program now under way.

tary, with self-interest pride in the achievement of neighborhood betterment, and satisfaction in leaving a heritage better than it was found, as the primary incentives.

This is a sketch of what we call the watershed conservation concept or today's "conservation-plus." It is a concept that has been taking hold in the public imagination with tremendous and snowballing force in recent years and months, rendering many existing government structures and procedures inadequate and calling for a new direction and emphasis in immediate and long-range national land and water policy. It is new vintage, and it bursts old bottles.

The Salt-Wahoo Story

I can't tell you how many times around the world I could have gone on the mileage I've run up in the race to make running water walk, although in the current 30-day span it will come close to 8,000. And since this is only a sideline to running a daily newspaper, I'm beginning to suspect that instead of my controlling the creek it's the other way around.

I say sideline, but really it is a part of my newspaper's obligation. Its masthead has long born the motto: "Dedicated to the people of Nebraska and to the development of the resources of the state." When the Missouri Basin Program began to unfold I felt it implicit in that pledge to find out for our readers all I could and especially since Nebraska is the only state wholly within that basin. As I followed the multi-billion dollar Pick-Sloan plan from inter-agency committee meeting to inter-agency committee meeting, I was more and more impressed that while it had benefits for Nebraska, these touched on the periphery of Nebraska's economy. It struck me that the great high-producing areas where the population was already located and the physical plant of cities and transportation facilities already built up were blank areas on the Pick-Sloan map although slowly but steadily their productivity was washing and blowing away.

This didn't make sense to me, nor to our very capable farm editor at that time, Stanley Matzke. Between us we could see a great deal of merit therefore in the Department of Agriculture comprehensive Missouri Basin plan, when it came out in 1949. If the Missouri Basin Program had been begun from the wrong end, or was improperly planned, here was a way to catch up at the right end, and to restore balance to the development. Its trouble was that it was too comprehensive for the people to comprehend. It was also too expensive to be authorized in one lump. And it proposed a kind of development which, since it depended on local cooperation, could not possibly be undertaken anyway except where and as the people did comprehend and were willing and insistent on moving ahead. I wrote Brannan and made an excursion to Washington to see him, urging him to break it down to a scale where people could see it and understand it, where it would be economically feasible, and so that authorization would be asked only for the localities that were ready to participate. He didn't want to, for reasons of his own. Bad reasons, obviously, since the plan was never authorized.

We decided we could show Brannan or at least ourselves that we were right, that the newspaper could study the alternating flood and drought problems of our own miniature basin, that of Salt and its tributary, Wahoo. We could prepare proposals for watershed-wide action which could not only alleviate those problems but demonstrate and prove what integrated and balanced planning and development, beginning at the beginning, could do. We would have this material ready, and spring it at the right time. We got ready for a coordinated attack on the triple and related ravages of flood, erosion and drought. We were prepared to propose, and to seek community acceptance of, a comprehensive objective — soil and water control beginning at the top — with conservation practices on the farm; continuing on down the tributaries with erosion control and small water retention structures; and including also whatever larger flood control structures and channel improvements then would be necessary to protect property downstream. We would seek not to protect city values at the expense of farm values, or vice versa, but to protect and enhance both, as would be inevitable if the objective were to be acceptable to farmers and city people alike, upland and bottomland farmers, and upstream and downstream interests.

All this while and for years back to the beginning of records, floods had taken their toll in one part or another of the watershed every spring. But after every flood every victim or community of victims had had his own narrowly-conceived ideas as to the solution.

The people of Lincoln had responded every so often by investing tax money in straightening and deepening the channel through and below town. The city of Ashland, down below, had responded year after year by sending angry delegations to Lincoln to protest our unneighborly practice of speeding flood waters onto them. The farmers upstream from Lincoln had for years been reckoning the year-in-year-out cost of flood producing rains in terms of their ruined crops, lost soil and deeper gullies. They had been holding neighborhood meetings, and passing resolutions among themselves, which went unheeded in the more spectacular news of city floods. They figured that in 10 years the farm community above Lincoln had lost $10 million from flood-producing rains. No one much heard them.

After major deluges there would be flood control meetings in Lincoln. At the biggest of these, 75 at-

tended. The record shows 75 different flood control plans — remove this tree trunk, raise that bridge; take out that-there kink. Nothing happened.

Then on May 8, 1950, came Lincoln's and southeast Nebraska's eye-opener — a flood that snuffed out 23 lives and $53 million worth of farm and city property, railroad facilities, and public roads and bridges.

In series form in The Journal we sprang our material on what could be accomplished by everyone in the watershed working in partnership — in a partnership of man with his natural environment, of neighbor with neighbor, of city dweller with farmer, and of government agencies horizontally across the board and vertically from local to state to federal government. We kicked off with an editorial, "It's Time To Get Together."

The upper Salt Creek farmers' committee agreed. They had a remarkably capable spokesman, a nationally recognized dairyman, later and still a state senator, and now a director of Resources for the Future, Inc., Otto H. Liebers — a fighter and a partner with me in this enterprise from that point on. Between us, we called a meeting of every government agency, city, state and federal, that was concerned or could possibly contribute in a comprehensive, economic, overall and permanent solution. This meant six soil conservation districts; six county commissions; three cities; a drainage district; the state of Nebraska — governor's office, Legislature and state highway department; and federally the Department of Agriculture and the Army Corps of Engineers. Neither irrigation nor hydro-electric power are feasible in our terrain. Almost everyone was there but the Hoover Commission — and the spectacle would have scared it away.

Out of this meeting came the consensus that while each of these branches or levels of government might do something, in part, there would have to be some way of tying all efforts together into a cohesive and purposeful whole, and of keeping them all going on parallel tracks. Every man's responsibility is no one's.

So at a mass-meeting at the State Fair Grounds the Salt-Wahoo Watershed Association, a private, nonprofit corporation representing the citizens of the whole area, was born, with the newspaper written into the corporation papers as a sponsoring agent and its editor and farm editor ex-officio board members. Mr. Liebers was and is co-chairman with me.

We set out with no particular engineering plans in mind. We were resolved only to bring into coordinate focus all the best skills and knowledge of any and all agencies, at whatever level, that could do anything economically justifiable about reducing damages from excessive rainfall at every possible point, wherever it occurred; and to apply this knowledge for the benefit of the watershed as a whole, not for any one part at the expense of another.

Many of the churches have been active in the program, seeing in it an application of Christian principles — in which each individual while looking out for himself sees to it that this helps, and does not injure, his neighbor. Who is a man's neighbor? Every person, farmer or city dweller, has had to see himself as a neighbor to every other in the whole watershed, if the Salt-Wahoo concept were to succeed. Many folks in Lincoln, like city people anywhere, knew little more about their natural environment than that Salt Creek ran through town, from somewhere to somewhere.

A first job of the Salt-Wahoo Association was to cultivate among the 135,000 people of the area an awareness of community — a sense of the common-ness of their problem and of the relationships of land and water, of conservation and flood prevention, involved in its solution. Toward this end as well as in order to persuade both resident and absentee farm property owners to do the necessary conservation job on their land, we have carried on a broad educational program through every medium including as you might guess the daily press, with the weeklies assisting. We have held hundreds of neighborhood meetings; organized dozens of chartered bus tours for farmers to see good conservation jobs for themselves; printed and distributed thousands of leaflets and booklets; and prepared through the University of Nebraska a color-sound movie which the Lincoln Junior Chamber of Commerce has undertaken to show to every group meeting in the city. We are now working up short film strips, on specialized aspects of the job. We have taken all the supervisory personnel of the school systems on airplane tours of the area.

The Kansas-Nebraska Story

By the following year we were getting inquiries for literature from all over the country. Watershed associations patterned after ours had been organized with our help, in five watersheds of eastern and central Nebraska covering a third of the land area of the state and including the Upper Big Blue. It was the same story in northern and eastern Kansas. One of the new Kansas watershed associations for which we supplied copies of our organizational papers and a speaker for the kickoff meeting was for Walnut Creek, and at that meeting a farmer, Howard S. Miller, was elected chairman.

By the fall of 1951 also a series of floods which had ravaged southern Nebraska couldn't see the state line and piled down into Kansas on top of the floods there and contributing to the Kansas catastrophe. My publisher and I felt that we could best help them, if we shared our ideas on conservation and flood prevention.

So in Lincoln The Journal was host at a meeting to which we had invited the watershed leaders of the two states and the daily and weekly newspaper editors and publishers. We filled the Cornhusker ballroom; offered a sounding board for all federal agencies — Army and Agriculture included — to expound a balanced view of integrated flood prevention and resources planning; and organized a loose Kansas-Nebraska Watersheds Council, financed modestly by the newspapers, to keep the new partnership alive through the exchange of information in a newsletter. The meeting helped offset a one-sided barrage representing the downstream point of view exclusively that had been let loose in Kansas City the week before at a meeting engineered by the Army only. In the longer run, it helped set up contacts and an awareness of mutual problems that paid off this year in Congress in the intimate working relation of our Nebraska delegation with the Kansas Hope-Carlson team in behalf of a watershed appropriation. Some of us in both states have visions — I do not think we are visionary — of setting the stage for peace, and plenty, on the physically and politically tumultuous Blue through a coordinated two-state partnership.

New State Legislation

One of our objectives at the outset was to obtain new state legislation. Most existing political subdivisions, in Nebraska as in the overwhelming majority of the states, are not shaped to fit Nature. The problems of a related watershed conservation program do not conform to city, county or state lines any more than runoff and silt from the next farm stops at your fence line. To date, soil conservation districts are the only vehicle through which watershed programs under the Flood Control Act of 1936 are being carried out. They will continue to be an important cog in any type of watershed program. Yet they have certain handicaps when it comes to handling an overall responsibility.

They are too small for the larger watershed jobs. Many are laid out along county lines. Except in the smallest watershed they can do the job only by joining together. Where this has been done, as in western Iowa's Little Sioux, it has tended to be a makeshift, with erosion control suffering. The districts lack the power to tax, and the power of eminent domain needed in most areas to acquire reservoir sites. Especially where the watershed problems are partly urban and partly rural, they are inadequate for the job. For a soil conservation district cannot remain farmer-controlled and fully effective in its on-the-land job while assuming responsibility for such other objectives as flood protection for cities and villages, recreation development, or improvement of city water supply.

Soil conservation district supervisors themselves generally have been the first to realize these limitations, and to lead the way for new or improved state laws — as they have been in the forefront of the watershed movement nationally.

The water control districts for which most state statute books are amply documented, on the other hand, for the most part follow the drainage idea, which is counter to the current of today's best conservation knowledge.

This was our reasoning in Nebraska in 1951 in seeking new state legislation enabling the formation of watershed districts somewhat similar to the conservancy districts of Ohio. We ran into opposition. Some of it was traceable to irrigation interests from too-dry, rather than too-wet, parts of the state. They helped bottle the bill up in committee, fearing it would disturb reclamation law. Before the 1953 session the watershed associations organized more thoroughly, and our proposal had been denicotinized by the Legislative Council. Also flash floods in cross gulches had badly damaged irrigation canals in the west, opening many westerners' eyes to their own stake in multiple-function soil and water control on a watershed basis. The legislation bearing Senator Liebers' name and enabling residents of a watershed to form a district if approved through elections, to adopt plans, to carry these out in cooperation with federal agencies and soil conservation districts, and to assess beneficiaries for the local share of the cost, passed in 1953 with only one dissent.

The Kansas legislation, born in the floods of 1951, has a somewhat parallel if briefer history. I recall being invited to a statewide watershed meeting in Topeka that year, to find them mostly yakking at the Army Engineers. I suggested that while yakking at a government bureau was a tested and approved American pastime, it was not the principal way in which to assert their initiative in getting a constructive job done. There was a tremendous amount of work to be thought through and done, on the positive side, if they were to have an effective and acceptable alternative to any single federal agency's plans. I like to think thatthis free advice, plus our own work of the previous season in breaking the ice in the Nebraska legislature, helped crystallize Kansas watershed aims into the act, roughly similar to ours, that passed through the 1953 legislature with ease.

In other states, as in these two, people are beginning to face up realistically to the inadequacies of existing laws and existing state policies to fit the new conservation pattern. Still even in these states, and certainly in most, there is a tremendous job remaining in improving legislation, in organizing districts, and in coordinating plans and aims, before all or even many of the states are ready for their full role in a real working partnership.

Soil and Water Conservation in Western Canada

L. B. THOMSON

The drought years of the "thirties" pointed to the need for an action program aimed at immediate and long term relief from the ravages of drought and wind erosion on the Canadian Prairies. By avoiding duplication of services, employing a policy of self-help and applying research findings directly to the problems in hand, the Government of Canada has made a noteworthy contribution to conservation, affecting at once the individual, the community and the country. On a long term basis, attention is being given to the development of large irrigation projects destined to cater to the resettlement and rehabilitation needs of farmers from drought ridden areas. Co-ordination with the farmer, the Provincial and Municipal Governments has been the keynote to success in all these programs.

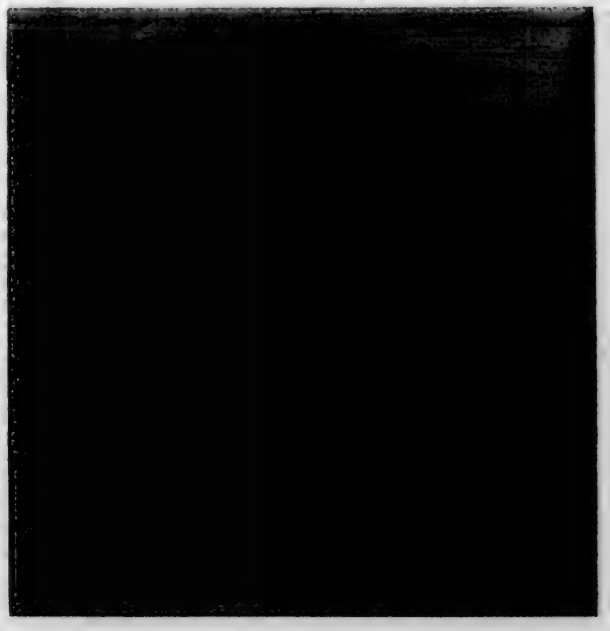
DURING THE "THIRTIES" all was not well on the Canadian prairies. Drought was leaving many human and land disasters in its wake. Soil erosion by wind had become a national problem and was threatening the entire grain growing belt of Western Canada. We were not alone in our trouble, however, for here in your western states the story was the same and newspapers the world over carried articles on our "Dust Bowls" and the many tragedies that attended them.

Since those depressing days much progress has been made to meet drought and erosion problems. Armed now with a fund of knowledge born of research and experiment, I believe we are in a good position to do battle with any challenge the future may hold. It is with this thought in mind that I begin this address and endeavor to present to you a brief picture of the soil and water conservation problems of Western Canada and how they have been met.

Fortunately for Canada, the United States Department of Agriculture had several years experience with drought problems before the same conditions created the need for a national policy in Western Canada. During the "thirties" I was one of those who had the opportunity of studying your problems, your countermeasures and your organization of government services to cope with the situation as a whole. Constitutionally Canada has been set up to invest much power and authority with the Provinces but the need to meet the emergent drought problems by the affected Provinces was rendered difficult through lack of funds. The combined onslaught of drought and depression had left the prairie Provinces practically bankrupt. To aid the prairies, the Canadian Parliament passed the Prairie Farm Rehabilitation Act in February, 1935. This act recognized several cardinal principles which governed the administration of a program to meet drought problems.

1. **Rather than initiate a new service in the Government of Canada, it was decided to work with existing Government Services, enlarge them, provide more funds, and use experienced personnel.**
2. **As the prairie Provinces had well organized Departments of Agriculture and active Universities with competent and experienced staffs, it was decided to implement measures under their direction and co-ordinate the work under the Prairie Farm Rehabilitation Administration.**
3. **Advisory and administrative committees were organized which included representatives for research, extension and education, as well as the farmer himself.**

On The Gap Community Pasture near Hardy, Saskatchewan cattle are watered from a small earth-fill dam similar to many built across the prairies under the Prarie Farm Rehabilitation Administration Small Water Development Program.



Dr. L. B. Thomson, director, Prairie Farm Rehabilitation Administration, Department of Agriculture, Government of Canada, Regina, Saskatchewan, presented this paper at the Eighth Annual Meeting of the SCSA held in Colorado Springs, Colorado, November 6, 1953.

Typical of the dust storms which swept across the prairies in the 1930s. This photo was taken 20 miles south of the town of Swift Current in Saskatchewan.

There were two types of problems facing the new Administration. They were:

(1) *The immediate problems*—soil erosion by wind and the lack of water for stockwatering, irrigation and domestic use. The regrassing of abandoned farm lands, the reclaiming of badly drifted areas along with the organizing of farmers to cope with local drought problems. There was a need for completing soil and economic surveys, for tree planting and many other activities all directed towards minimizing the effects of drought and wind erosion.

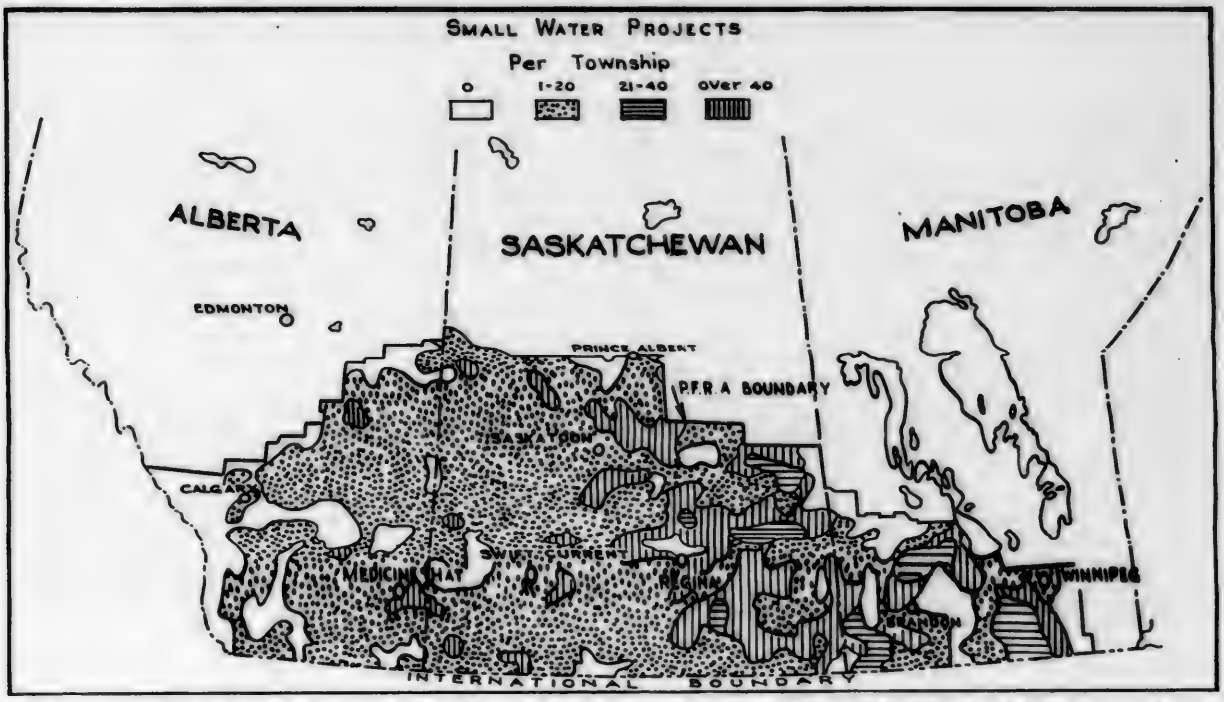
(2) *The long term problems*—these consisted mainly of harnessing water resources for the irrigation of land. Once irrigated this land would serve to resettle farmers from areas that were unsuitable for crop production and provide them with a secure future. In addition, there was a need for constructing large water storages along hundreds of miles of prairie streams and rivers to supply stockwater through the years when they would normally be completely dry. On those abandoned lands, reclamation measures were needed to transfer a liability into a national asset.

Results of Work on Immediate Problems

To meet the immediate problem of soil drifting it was not a question of writing bulletins and making speeches —it was simply a question of combining research knowledge with farming experience and embarking on a program of action. Fundamentally, research provided the means to go to work. Years of experimentation with the wind tunnel had already determined the principles for soil drifting control. These were—tillage methods which provided a cloddy condition for all soils and tillage methods which left a top cover of trash or stubble firmly anchored in the soil to prevent the abrasive action of wind. (This is commonly called "stubble mulch" in the U.S.A. and "trash cover" in Canada.) Strip farming, too, was adopted to reduce the effect of wind erosion. No one of these features was a complete answer but the combination of all three, intelligently applied, has resulted in practical soil conservation on different soil types. It may be said that the last 18 years has resulted in the coming of a completely new philosophy of dry land farming for the farmers of Western Canada. The tillage practices of 20 years ago are practically extinct today. I do not know of any work so unspectacular and yet so vitally effective and inexpensive to the Nation. It has been a great achievement for the research worker, the extension worker and the farmer. While there will still be danger signals of soil drifting to watch for in future dry years, I believe that the soil drifting problem will be greatly reduced.

While many phases of the soil drifting program could be described, most of it is known. However, if some lessons can be learned from experience, there is one I would like to describe briefly for I believe it has much merit for future application to soil and water conservation work. The lesson concerns our Experimental Farms Substations. These substations were set up on 640 acre units on private farms throughout the prairies. They were located on areas representative of one hundred to three hundred farms and their primary purpose was to seek out the best dry land farming practices for local soil and climatic conditions. Experienced farmers were selected for this work and they combined their skill and experience with the most up-to-date research knowledge available. The substations became the outposts of agricultural science for the Government. Here was embodied all related work of water conservation, tree planting and sound dry land farming. *The substations were examples, as distinct from demonstration farms, and a direct contact for all the farmers in the district. In my experience I believe that this plan was the most productive of all forms of education pertaining to soil and water conservation. I also believe that for future conservation work in Canada their extension is vital. The cost to the Government is small and it has the added merit of being a truly self-help plan.*

Another immediate problem that has received considerable attention is that of water conservation on individual farms. The Government of Canada has provided engineering services necessary for the construction of small dams, dugouts and farm irrigation projects. Basically these schemes are designed to conserve and utilize spring runoff water which would normally be lost.



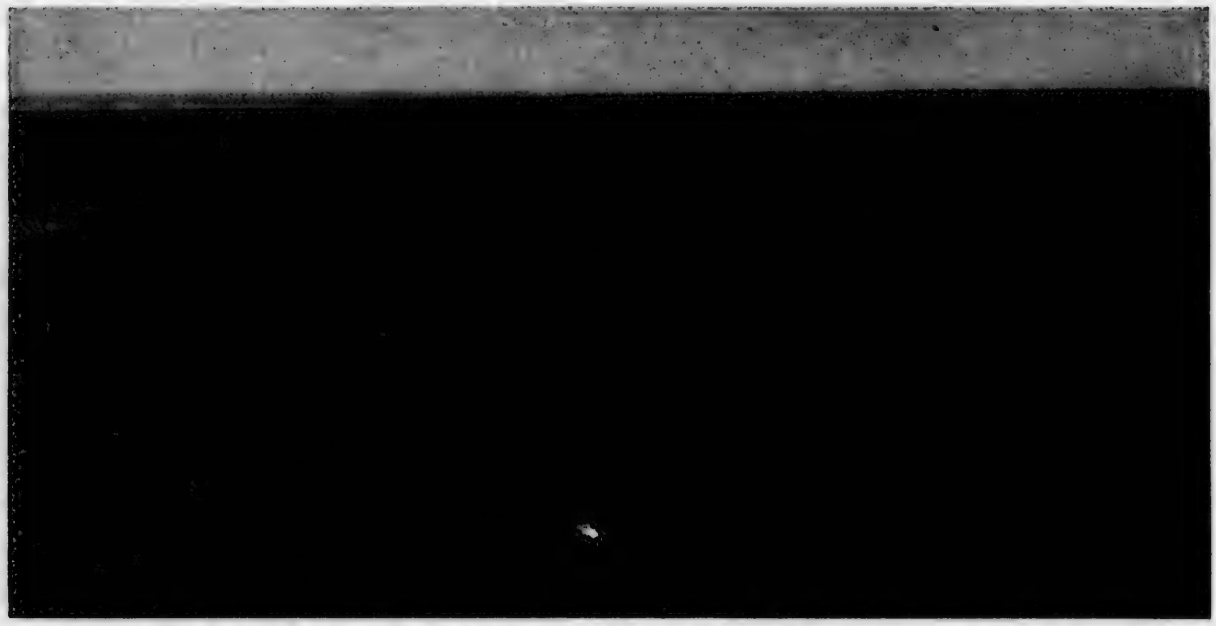
This map shows the current distribution of small water projects within the Prairie Farm Rehabilitation Administration Area

It was realized at the outset that the cost of such works would be prohibitive to the average farmer but at the same time the works themselves were a national investment. In view of this the Government provided financial aid on a self-help basis which over the years has amounted to approximately one-third of the total cost. Since the inception of this program over 50,000 individual farm projects have been constructed by farmers. These people are now assured of water in the future while within their area of over 65,000,000 acres better than 250,000 acres are irrigated by these small schemes. The cost to Canada for this far-reaching development has been $6,000,000. We consider this a sound public investment and one which has wide application. Looking ahead we expect to double the present number of individual projects during the next 15 years. No doubt there are many other areas in Canada where this plan will be applied to meet water conservation needs.

Aside from the individual projects mentioned, other water conservation plans have been in effect. Five hundred neighbor and community water storage projects have been constructed to serve the needs of irrigation and stockwatering. On these projects the Government of Canada pays the cost of the capital works with no return. The cost of works necessary for the utilization and application of the water is borne by the local organized body or by the Provincial Government. Once more the principle is one of self-help, while at the same time an investment is made in resource development by the people of Canada to enable farmers to provide for security in the future.

I would be remiss in my duty if I did not refer to other conservation and land use problems in Western Canada. To this point most of my remarks have been confined to the drought problems which, of course, were the immediate problems so necessary of solution.

However, in other farming areas of the west, erosion of land by water has reached serious proportions. Stream bank erosion, slips and landslides and unwise land use have all contributed to flood problems. Fertility has been lowered and the productive efficiency of land has been impaired—in some cases permanently. It is a major problem and one that is receiving the best attention by Governments. While there are many farms where the problem has advanced beyond individual control, in the majority of cases the problem of soil erosion by water is still capable of solution by the individual application of the practices of good agriculture. After all, good agriculture is the basis of good conservation. I believe our knowledge of good agriculture, coupled with our current agronomic research, can allow us to implement a sound conservation plan. Research is gradually catching up to the farmer with his own accumulated experience. With these two powers working in unison much can be achieved.



In the central section of the Bow River Irrigation Project near Hays, Alberta, the Federal Government has established a resettlement project to accommodate farmers from drought-ridden areas. A newly constructed irrigation pattern shows up clearly in a swathed wheat field.

While I recognize that there is still much to accomplish I believe that with the present basic organization we can look to see much accomplished in the next 15 years. As one who administers the main federal conservation program for Western Canada and as one who has been working closely between the Governments has been responsible for the achievements we see today. Without such undrstanding confusion, mistakes and disaster will surely follow. Confidence must be maintained in all Government services if any project, no matter what it may be, is going to serve the people who use the land.

Long Term Program

Most of my remarks have been confined to immediate programs; those on the long-term program will be relatively brief. We do not have large scale water conservation and reclamation projects in Western Canada when measured by the yardstick of the great projects you have constructed and are now constructing in the Missouri, Columbia and other basins in the western states. However, our projects to us are large, covering as they do the conservation and control of the waters from the Rocky Mountains. Two projects are already under construction to irrigate over a million acres, while other projects capable of irrigating a further 3,000,000 acres are currently under investigation. The main purpose of these projects is to provide irrigated land for the resettlement and rehabilitation of farmers from drought-ridden areas. In addition they will form an insurance for feed and seed and food for people in the event of a return of drought. They become a productive network of safety in a 100,000,000 acre area of 300,000 farms.

These projects will involve the expenditure of many hundreds of millions as a public investment. We believe it is sound and contains the resource approach which will insure everlasting benefits to the Nation and provide for the needs of an increasing population.

There are many other water conservation and reclamation projects under way in Western Canada. The work under the Prairie Farm Rehabilitation Act has grown during the past ten years to such an extent that it has broadened its activities to fields other than drought rehabilitation. I believe it has grown in such a way as to serve the conservation needs of Canada. Rather than set up a large organization in 1935 with a large overhead in personnel, which would have meant robbing existing services of experienced workers, it has been a program of gradual development on the self-help plan with administrative action co-ordinated among the various departments of Government. When demands for conservation or reclamation work came to the Parliament of Canada and where this work was beyond the immediate scope of the Prairie Farm Rehabilitation Act, Canada agreed to consider proposals made by the individual provinces. Over the years many such proposals have been made. *Canada has provided engineering and other services to assist the provinces in a proper appraisal of the projects. Finally, the Government of Canada gives*

consideration to the project and, if approved, an agreement is usually undertaken with the province concerned. In all such agreements, the general principle is that Canada assumes the cost of all capital works for water storage, reclamation and flood control while the province in question undertakes all expenditures involved with land, water, farm operations and settlement. Since all land and water resources are administered by the provinces the general agreement and implementation works out quite satisfactorily. Once again the cardinal principle is followed where local autonomy prevails and where local understanding is necessary to obtain a wise expenditure of public money.

Conclusion

There are many aspects of soil and water conservation that could be discussed and I realize that I have just scratched the surface. There is still a great task ahead if we are going to conserve the *renewable* resources of the nation. In conclusion there are a few comments I would like to make as a result of our experience in Canada.

1. ***The complete co-ordination of all governing agencies is necessary in order to see that a sound land use plan is followed. Centralization of conservation work is only effective up to a point and can be ineffective unless tied closely to the people on the land.***
2. ***Soil and water conservation is greatly influenced by land use. It cannot be divorced from agriculture. Throughout the world many attempts have been made to separate conservation of land and water from agriculture. This is a mistake as experience has shown. Conservation of the renewable land and water resources is just good agriculture.***
3. ***The sciences of engineering, soils, plants, animals, economics and all other related sciences, must be marshaled together in team work. Independent agencies endeavoring to cover the whole field only result in confusion.***
4. ***I believe great progress has been made over the past 20 years, both in the United States and Canada. This Society can do much to strengthen the understanding of conservation workers over the continent. It can go further and be of great value to the world in encouraging leadership in those countries where people are hungry and living in a starvation state at the present time.***

Resources for The Future—An Appraisal of The Mid-Century Conference

BERNARD FRANK

The Mid-Century Conference on Resources for the Future, covering three short days in December 1953, may prove to be a significant experiment in group thinking and collaboration. Financed by a grant of around $190,000 from the Ford Foundation on Human Relations, the conference attracted nearly 1500 people from virtually every state in the Union, and several foreign countries.

THE AVOWED PURPOSE of the Conference was to provide an orderly forum for the free discussion of live and controversial issues on the conservation, ownership, and disposition of the Nation's most important sources of strength — people, land, minerals, and water. The conference was not intended to reach formal conclusions on any of the eight major aspects of resource problems which were discussed. Rather the expressed thought of its sponsors was to bring out an array of facts and judgments on progress, problems, and opportunities which might stimulate further, more comprehensive discussions and studies from which both public and private interests might jointly work out their future policies and programs.

The conference was divided into eight main sections: I—*Competing Demands for Use of Land;* II—*Utilization and Development of Land Resources;* III—*Water Resource Problems;* IV—*Domestic Problems of Non-Fuel Minerals;* V—*Energy Resource Problems;* VI—*U. S. Concern with World Resources;* VII—*Problems in Resource Research;* and VIII—*Patterns of*

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Cooperation. The program for each section (and subsection) was outlined by a separate steering committee which developed its detailed theme from the broad guidelines furnished by a background statement prepared by the Brookings Institution. The formal presentations and comments were recorded verbatim by two reporters and summarized later.

The two general dinner meetings featured panel debates on *"Who should control the public (Federal) lands?"* and *"The Nation's position on world resources."* The final session featured the presentation of sectional reports followed by questions and comments from the floor.

View of Conferees

Although the subject matter of all the section meetings relates in one way or another to our field of interest, Sections II and III most directly and immediately concern the Soil Conservation Society. However, the discussions of the other sections are summarized below to indicate the scope of their coverage, the issues considered, and the relations to our own interests.

Section I. Much excellent farm land is going into urban, suburban, industrial and military use, etc. Conflicts are intensifying in the use of wet lands. The additional crop production provided by drainage is aggravating present surpluses, raising questions as to whether this trend is currently in the public interest. The conferees suggested that we bring our scientific knowledge of wild lands more nearly in line with that for cultivated lands, and proposed a new Nation-wide land resource appraisal to meet prospective future needs.

Section IV. Strong disagreement was apparent on the extent to which unrestricted mineral exploration and development on public lands should continue, especially in areas valuable for recreation and other public purposes. Subterfuge claims were generally condemned, and mining industry representatives appeared favorable to cooperating in correcting this serious abuse of the mining laws. However, acceptance of responsibility for reducing surface resource damages from legitimate mining was less evident.

Section V. Estimates of energy resource reserves based on existing technology may be entirely inadequate as a guide to what future reserves may be available. For example, the impact of atomic energy may be very great with respect to supplementing existing hydroelectric sources, although it is not known how soon this will happen. The availability of solar heat and other energy sources depends largely upon technological advances in relation to economic factors.

Section VI. Several issues are involved here: (1) what should be our commercial policy on raw material imports; (2) by what effective means can foreign resource development be assured; and (3) what special devices might be employed to stabilize raw material prices. Much agreement obtained on the nature of the major problem, but relatively little on its solutions.

Section VII. Fundamental research in renewable resources is vital. Its future depends first and foremost upon highly qualified personnel, second, upon adequate communications among scientists and between scientists and technologists, and third, upon the integration of the cumulative and new knowledge obtained from areas of different specialization but more or less closely interrelated. The serious shortages in trained scientists and in funds require the exercise of great care in determining research priorities and in judiciously allocating personnel and funds accordingly.

An important need in water resource research relates to the control of precipitation, including an exhaustive study of the scientific principles underlying meteorology and oceanography. Yet fundamental research in these and other renewable resource fields holds little interest for students, a lack attributable to the few job opportunities available, despite the great potentialities for assuring adequate water supplies for agriculture and other purposes by cloud-seeding and desalting sea water. In this and in other fields the Government should conduct much more basic research, leaving more of the applied phase to private interests. Fundamental research itself represents a resource which deserves great emphasis. Despite increasing specialization, research represents a collective effort, and in training scientists our universities should therefore stress the importance and rigorous requirements of interdependent activity.

Section VIII. Cooperation must begin at the grass roots and extend throughout all levels of organization. Many examples and problems occur in the renewable resources fields, as in forestry, farming, wildlife management, watershed improvement, regional authorities, interstate compacts. Local initiative is essential but responsibility and leadership must be shared with the broader fields of government, and both public and private groups must organize to facilitate more effective cooperation. All this requires more adequate research on human relations techniques to speed up the application of science, and the dissemination of knowledge.

Rural Lands and Water Resources

Section II was divided into four subsections: *Food and Non-Wood Fibers; Timber and Wood Products; Wildlife, Scenic, Wilderness, and Other Recreational Areas;* and *Watershed Values.*

Although the subsection meetings were held concurrently, and on rather specific topics, common agreement

generally was expressed with respect to soil and water conservation issues. Discussions in all subsections recognized both material and non-material wants in resource programs, and endorsed research — particularly basic research — education, technical assistance, and financial aids, as well as greater acceptance of responsibility by local people. Opinions were almost unanimous that action programs should go forward promptly. In the meantime we have the problem of overcoming the present deficiencies in knowledge of what constitutes optimum land use, a specific gap which research should help fill.

The conferees generally agreed that Federal lands should remain in public ownership and control as the most desirable form of organization for carrying out their multiple-use purposes. However, they were generally in favor of reviewing the present status of such lands and combining similar land management activities.

Conferees favored the small watershed approach as the logical unit for planning and action. Programs should deal with all the resources and problems involved, and local people should endeavor to improve cooperation between agencies — both Federal and State — but maintain control. The human and social aspects of watershed programs provoked lively discussion on how to obtain greater and more effective cooperation in applying watershed measures, and more particularly, in maintaining them. The note of optimism on this subject was tempered by a realization that this question has not yet adequately been answered for farm, ranch or forest lands in the United States, and that permanently maintained watershed measures are vital not only to assure the stability and productivity of the treated lands but also to protect engineering structures — large and small — and the values and investments dependent upon them.

As one would expect, the water resources sessions (III) somewhat overlapped the watershed subsection (II-D). However, the former dealt primarily with the larger undertakings and their broader aspects. Conferees questioned the wisdom of too readily committing the large expenditures required for huge multi-purpose projects in view of the inadequate information on dependable water supplies, and on the estimates of expected physical gains from the developments. Other obstacles discussed included the conflicting concepts of what constitutes standards of water quality, especially as it relates to pollution, the confusing legislation on water resources, and the unsatisfactory methods of evaluating costs and benefits.

Members cautioned that unless unforeseen technological developments completely change the water supply picture, we must choose our developments carefully and for the maximum multiple values because "we can no longer afford casual choices" that irrevocably "commit a region's economic future." (In this connection, engineers were taken to task for their common failure to consider the broader economic and other human values affected by their projects, and for their inclination to overlook the interdependence of land and water and to dismiss the contribution of upstream land management and structural works.) Economic evaluation of water resource projects was recognized as a useful but imperfect tool that needs much sharpening to cover more effectively the benefits to nation and locality, and "it should not be dulled to blur the public understanding of benefits, costs, and subsidies involved" in given projects.

Accomplishments and Prospects

We obviously cannot expect so many people, meeting for so short a time, and with so little opportunity for interchange of ideas, to do more than learn a little about the interests of others, and perhaps gain a few fresh viewpoints about their own concerns. It is not surprising, therefore, that the conference accomplished little unanimity on specific issues, and developed no startlingly new ideas. At best, it can be viewed as a faltering step toward achieving a closer mutual understanding of diverse points of view and a limited accord among groups whose economic interests and outlooks usually disagree. However, if the conference does lead to more down-to-earth considerations of the major problems within its scope, and thus helps to narrow the gap between our available knowledge and its lack of application — and the causes — it will undoubtedly have achieved the stated purpose of its sponsors.

Even so it can be criticized on at least three major counts: (1) an overstress on agreement at the expense of the disagreements, (2) an inadequate integration of the discussions of the conference as a whole, especially as to the nature and scope of the problems common to all subjects, (3) lack of an evaluation of the discussions in relation to the four major questions posed in the Brookings Institution background statement.

So far as soil and water and forest conservation issues are concerned, the conference as a whole did evoke widespread agreement on two significant points: *The desirability of accelerating soil and water conservation on public and private lands, and the continued retention of Federal forest and range lands in public ownership and control. What influence these expressions will exert remains to be seen.*

Gaining Public Understanding and Support for Conservation and Resource-use Education

RICHARD L. WEAVER

Conservation and Resource-use Education have made real progress in the last twenty years, coincidental with an awakening on the part of many people of the concern of professional conservationists of the critical situation confronting the United States.

The terrific toll of resources for war, resulting from ignorance or refusal to employ sound management techniques, the rapidly expanding populations, and the dwindling acres for production of renewable resources all pose problems for the educator as well as the technician.

Public school and college people are finding and using new techniques in training citizens and teachers to make conservation and resource-use education an important and an integral part of education today. Dr. Richard L. Weaver points out some of these newer trends which are highlights, but not at all inclusive of the tremendous activity in all parts of the Unied States.

Richard L. Weaver

THERE HAS NOT BEEN too great a dearth of conservationists and resource specialists since 1900 telling the educators what they should do in order to help people acquire the right habits and attitudes about resource-use and conservation.

Charles R. Van Hise in his comprehensive text, "Conservation of Natural Resources in the United States," gave us the basis for a general course in conservation in colleges which was used as a standard text and reference from 1910 for 30 or more years, particularly by geographers.

Pinchot, Fernow, Graves, and others pioneered in the field of forestry and led in the establishment of our national forest program and the creation of the first schools of forestry. Theodore Roosevelt, as an administrator, traveler, and naturalist, and the instigator of the First White House Conference of Governors on conservation in 1908, aided the states in seeing the importance of conservation. This leadership helped to draft the plans for many of our present day state departments of conservation.

John Muir, Enos Mills and a handful of others dramatized our unique western heritage of scenic wonders and resources which inspired the development of a sound philosophy of national parks to be held in trust and to be used for the recreation and appreciation of all of us.

Gilbert Pearson assisted by many nature enthusiasts, ornithologists and scientific groups stopped the slaughter of wild birds for their plumage, organized the early Audubon groups, and obtained passage of many early game laws. Ernest Thompson Seton's writings and research captured the interest of hundreds of thousands of our people in behalf of our heritage of animals in the wild. John Burroughs likewise aided greatly in obtaining an appreciation on the part of many laymen toward our everyday wonders of nature.

Even though wildlife and recreation were not important parts of the first White House Conference on conservation, they were of considerable concern to many lay people at the time.

A stubborn Congress and Cabinet composed of individuals more concerned with "private gain than public good" prevented much of the implementation of the resolutions of this well-planned and conducted first conference.

While the states were getting the state departments of conservation organized in the 1920's and the federal government was busy setting up and staffing the Park Service created in 1917, the Biological Survey, and in enlarging the Forest Service, the problems of what to do with public domain, the Indians, and the new oil riches, and how to meet the terrific demands of resources for war, were descending upon us.

This paper by Dr. Richard L. Weaver was presented at the Eighth Annual Meeting of the SCSA held in Colorado Springs, Colorado, November 7, 1953. He is now engaged in training conservationists and conservation educators at the University of Michigan, Ann Arbor, Michigan. Dr. Weaver is also secretary of the recently formed Conservation Education Association and project leader for the three-year Conservation Project being conducted by the National Association of Biology Teachers.

New Resource Problems Born in War and Depression

We moved into the period of many extravagancies—inflation following the war which later led to the depression and great unemployment, over-use of western lands for meat and wheat to feed the war machine which later led to the dust bowl, one-crop cotton or tobacco farming in the south which led to "boom and bust" by the depredations of the boll-weevil and the rapidly eroding soils, and a raid on our timber resources by "fly-by-night" wood-using industries which encouraged ghost towns, fires, etc., from which we have never really recovered.

Thus, by the mid-depression years when another Roosevelt was called upon to revive a sick economy, to put millions of unemployed to work, to "prime a lot of pumps" in wells nearing the danger point, by federal assistance, and to try to tie down the dust bowl with grass, to stop erosion in the one-crop farming areas of the south, and to replant the abandoned cut-over forest areas and abandoned farms, to resettle the bankrupt subsistence farmers from these areas, we had the support of our citizens on many major national programs designed to give guidance on these important resource problems.

New problems in the far west and south arising from rapidly expanding populations, agricultural and industrial expansions, demanded new tools, new agencies, and some new thinking to provide the help and encouragement necessary. Continuing floods on our major rivers and the need for new agricultural lands, new power, all brought on a greater intensity of planning and thinking on resource problems by government, industry, and by laymen.

A second world war with its terrific drain on our dwindling resources and its demands to plow under some of the reseeded danger areas in and around the dust bowl, and the tremendous wastage of iron, lumber, oil, and numerous other resources, as we perfected the art of killing people, did little to promote sound resource-use development programs. When we realize that most of our wars have resulted from the age old struggle of the "have not" nations seeking resources at the expense of those which "have," then perhaps we can well afford the luxury of one or two battleships or atomic bombs being diverted to the art of international planning, cooperation, and sharing in such a way as to avoid such wasteful and costly conflagrations.

New Organizations and Leaders

The birth of the Soil Conservation Service, the CCC, the AAA, WPA, the farm loan agencies, the Taylor Grazing Districts, the REA, the TVA, and many other

Figure 1. This group of school children in North Carolina are on a field trip, observing and studying a tobacco bed laid on the contour.

conservation programs was hailed as real progress in the struggle to make order out of national chaos.

New leaders such as Hugh Bennett, Ira Gabrielson, Harold Ickes, emerged and obtained lay support through the forceful writings and cartoons of Ding Darling, Paul Sears, Louis Bromfield, Fairfield Osborn, and William Vogt.

A second White House Conference in 1936 devoted largely to wildlife conservation ushered in an era of intensive management of lands and habitats for wildlife, geared to sound land use practices on the farms and in the forests.

Likewise a new awareness on the part of industry led to the creation of the American Wildlife Institute which developed a research assistance program through the creation of numerous cooperative wildlife research units in the states, and the creation of conservation camps for youngsters. Lumbering firms began to hire foresters to grow trees near their businesses as they had no new places to move to. The oil industry decided to get some regulations in states to help control over-production and to conserve oil and gas by better management.

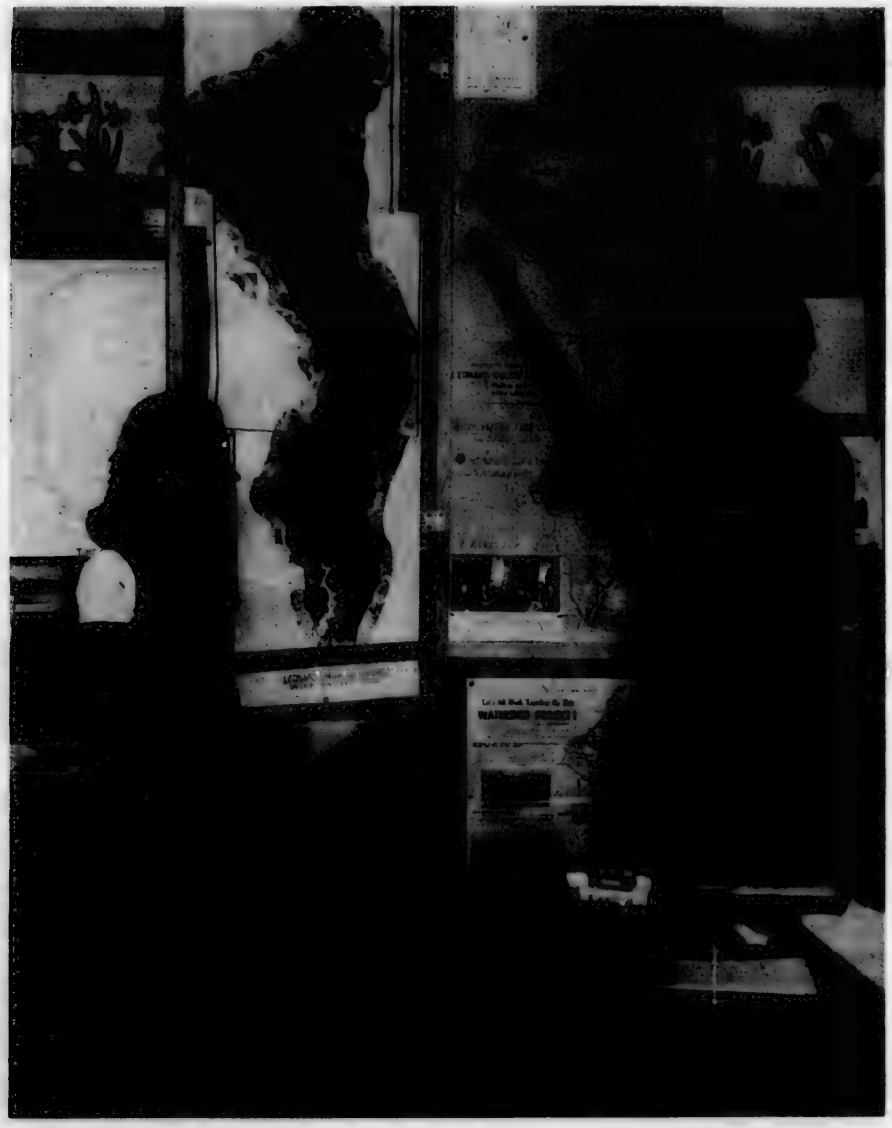
New professional societies were born to lend support to such old-timers as the Audubon societies, the Izaak Walton League, the American Forestry Association, and the American Nature Association. Many of us assisted with or witnessed the birth of the National Wildlife Federation, the Soil Conservation Society of America, Friends of the Land, the Emergency Conservation Committee, the Conservation Foundation, the Wilderness Society, the National Parks Association, the Sierra Club, the National Association of Soil Conservation District Supervisors, the National Association of Biology Teachers, and many others. All of these have had

tremendous influences in formulating and moulding public opinion and in winning approval of sound conservation practices.

Recently, a Mid-Century Conference on Resources for the Future was held in Washington, D. C., where another look was taken at our national resource stockpile. The findings of this group should be helpful in drafting a long range program of resource-use development, which will permit all of these many conservation groups already organized, the many interested industries, and the school people of the country to work effectively together on common goals and resource objectives. It came as a complete shock to some of us to find that the leaders of this important conference had somehow failed in seeking the help of many of the already organized professional conservation groups, and that they abandoned the original idea of a section on conservation education. May some of you lend your support in rectifying these two important omissions, by your presence and your thinking.

College training programs for technicians were speeded up to meet the increasing demands for foresters, wildlife managers and more recently fishery technicians, soil technicians, and hydrologists. Forestry schools such as at the University of Michigan had to expand their offerings to take care of these new demands.

Figure 2. A sixth grade school teacher and student of Wallburg School in North Carolina studying the Leonard Creek Watershed project.



Conservation Education Beginnings

State Departments of Education moved more slowly in providing help in conservation education to the public schools and teachers' colleges, despite a lot of prodding by state departments of conservation and in some cases by liberal "spoon-feeding programs, such as in Ohio and Michigan. A few states, Florida, Arkansas, Oklahoma, and Wisconsin have tried legislation requiring the teaching of conservation in all schools and colleges, but not much more progress is found in these states than in some without specific legislation.

Cornell University in 1936 embarked on a program of graduate studies underwritten by Pack Foundation funds which permitted some 50 of us to do our graduate work in the field of conservation education. The heart of the program has centered around the natural sciences. These investigations, the travels of the students and staff, and the publications of the results, contributed greatly in an area where not too much leadership had emerged since

the days of Van Hise at Wisconsin and Parkins at Peabody College for Teachers. A new text by four Cornell professors, *"Conservation in United States,"* was soon matched by four or five others designed for college use, and we saw the first of the texts prepared for public school use during the thirties.

Summer nature camps in New York, Pennsylvania, West Virginia and New Hampshire helped train some teachers. Many teacher training institutions were now offering one survey course in conservation using some of the new texts, which were elected by many teachers. Such schools as the teachers colleges at St. Cloud, Minn., Stevens Point, Wisconsin, Michigan Normal College at Ypsilanti, began to emerge as leaders. Many others have now joined in on the important work.

Conservation departments in Michigan, Tennessee, and Missouri pioneered in conservation education using field trips, training camps, traveling museums, films, lectures, and printed materials effectively. Field staffs of educational consultants have been built up with Missouri and Michigan having ten or more such trained men in the field helping schools, colleges, school camps, and youth groups. Other states like Pennsylvania, New York, New Jersey, Virginia and California, while setting up educational divisions and publishing excellent magazines, have not tried to build up large field staffs to assist schools. They have published many helpful materials and the small staffs have given excellent service in workshops, teachers' meetings and the like.

Generally the naturalists and resource specialists were noted for their devotion to birds, mammals, trees, fish, and soils, and little acceptance was evident of a broader interpretation of conservation. School people have looked upon such help skeptically, feeling that these technicians and scientists were outside pressure groups trying to force them to give school time for growing more birds for hunters, more trees for lumbermen, etc. Foresters have had to go out to schools requesting time to show their films on fire control. Many times such people have been cast in the role of special pleaders for the causes which they have believed in. They have been rebuffed by school people many times with excuses that the curriculum was already too crowded, there was no time for field trips and excursions, school forests, school gardens or school camps. These did not lend themselves to the educational curriculum as it is now organized. Educators seemed to have little incentive to flock wholeheartedly onto the gradually increasing conservation "caravan." Nor did the conservation specialists endeavor to use the social science tools at hand or to see why their ideas were not readily accepted. In fact many were and some still are super-critical of Schools of Education, social scientists, and the advocates of more attention to human resources. They lose patience with those of us who try to interpret resource-use as a means for resolving important problems of people and communities by greater concentration on group growth and development, communication skills, and better use of our human, social and natural resources. Many so-called conservationists have declared in national meetings, "we are concerned only with natural resources—forests, wildlife, soil, and water, we do not feel that conservation should include human resources. We have enough to do to take care of the natural, let the health and safety people look out for the human resource problems." Well, I ask you what is the objective of all of our conservation activity anyhow? Are we not interested in improving the level of living of all peoples within the ability of our natural resource potential? Are not the major problems of getting good land use practices on the land the result of our inability to interpret our research and to gain public acceptance of our ideas resulting from scientific research? Is it not our failure to use the communication skills available? We have known *what* to do for a long time; we don't seem to know *how*, which limits our conservation programs. Well, fortunately, there are some signs of progress in this direction. Let's review several.

New Approaches to Resource-Use Education

One exception to this narrow approach has been the development in the south of a new program called Resource-use Education, which was so-called in order to build some bridges between the natural scientist, the social scientist, and the professional educator. Needless to say it was the outgrowth of some important thinking and planning by a group of social scientists, headquartered to a large extent at the University of North Carolina and ably assisted by staff members of TVA, leaders who recognized the specific resource and human problems of the south, a real need for using the best tools available in their solution.

This Resource-use Education program underwritten by Rockefeller Foundation funds stimulated active programs in most of the thirteen states, using state and regional work conferences and workshops to analyze the problems, gather the data, design plans of action, and to stimulate interest on the part of public school people and staffs of teacher training institutions and state departments of education. The record of accomplishment in this one region, spearheaded by a regional committee for ten years which guided the expenditure of over 100,000 dollars, remains unsurpassed anywhere in this country.

The acceptance, promotion, and adaptation of the "workshop idea" to conservation and resource-use education by this southern group is probably one of its

major contributions to our present day assets as far as newer techniques is concerned. "A Guide to Resource-Use Education Workshops" prepared by some of us who had the privilege of working in this regional program, was published by The American Council on Education, the parent of the Committee on Southern Regional Studies in Education. Note conservation was not included in the title of the committee, education was substituted for it purposely. In this publication you will find the special features and advantages of workshops over traditional methods well defined. Witness the reaction of one of our outstanding conservationists of the traditional school. He looked at it and said "no conservation in it," demonstrating a complete lack of appreciation of sound methodology.

An equally important product of this southern planning was the creation of state commissions and committees to coordinate resource-use education at the state levels, and the appointment of special advisors or consultants on resource-use education in state departments of education. Underlying all of these programs has been the acceptance of the community-school, problem-centered curriculum to aid in the improvement of the level of living of everyone, embodying the fullest use of all available resources—the natural, human, and social. Likewise an emphasis on having teacher training institutions become service organizations for the improvement of living in their areas was a major step forward. The outstanding example in North Carolina where I had the privilege of working for five years, devoting full-time to resource-use education, was at the North Carolina College for Negroes at Durham, where a full-time coordinator for the college was appointed.

In North Carolina where 52 state agencies and professional groups worked together for five years in a state-coordinated program, major changes were a matter of public record, as demonstrated in the annual summer work conferences where school administrators, teachers and supervisors reported on their progress and planning. Resource specialists and administrators had an opportunity to hear and see the results of their assistance at the local level and in the colleges.

Meanwhile at the University of Michigan, a new approach to graduate training was taking shape, under the leadership of Dean Samuel T. Dana. The School of Forestry and Conservation was reorganized into a School of Natural Resources with a new Conservation Department. In it students would be able to receive training in resource development with equal emphasis on the social and the natural sciences, and a broad background embodying all the newer developments in education generally, in economic education, group dynamics, international resources and population problems, radio and television skills, and workshop procedures, under the direction of the new dean, Stanley G. Fontanna, and Stanley A. Cain, Head of the Conservation Department, and the twenty staff members of the School. The real implications of the philosophy behind the program were well-outlined in an article last year in your own magazine by one of our graduate students, Bradford Hall.

The recent contributions of some of the professional educational organizations has helped to speed up the transfer of the responsibility for conservation and resource-use education from the conservationist and resource specialist over to the curriculum planner, school administrator, and teacher trainer, where it rightfully belongs and where it has never really enjoyed the respect which it demands generally.

The newly organized Conservation Education Association, successor to the National Committee on Policies in Conservation Education, is developing a program which is designed to give leadership in national, regional, and state work conferences, and in teacher training workshops, and to prepare conservation materials and guide lines on sound resource development. Through it we will be able to encourage the development of regional and state groups, conferences, and committees to get more conservation and resource-use education into the curriculum. We will work with the Mid-western Conservation Education Conference consisting now of Illinois, Iowa, Minnesota, Wisconsin and Michigan, and with the thirteen states of the southeast in their Resource-use Education projects in an endeavor to make all of these more effective. The new Conservation Education Association is meant to supplement and implement the important things which you are doing and not to compete with them. We also want to work with the National Aububon Society, the National Wildlife Federation, and American Wildlife Institute, the Conservation Foundation, the Izaak Walton League, the American Nature Association, the Natural Resources Council, and such professional organizations as yours, the National Association of Biology Teachers, the National Education Association, the American Association for the Advancement of Science, the American Biological Institute and other groups interested in conservation and resource-use education.

Recommendations for Action

Here are some of the things which I feel we all need to give our attention and help to:

1. Urge and assist State Departments of Education to employ full-time conservation educators to guide the work at the state level, men who are hybrids believing in both content and methodology, and who can develop good working relationships with all groups interested.

Figure 3. *Left.* A group of sixth grade students examining a soil profile near Wallburg, North Carolina. *Right.* This group of school teachers are interested in conservation. They are studying land use conditions and corrective measures needed to stabilize the soil and improve the cover.

2. Urge and assist with the establishment of state commissions or communities composed of representatives of all of the important resource agencies and professional educational and scientific groups in the state to plan, develop and administer through the proper channels a strong program in each state, in which all who have something to contribute can do so effectively.

3. Urge and assist with the establishment of effective teacher-training programs in all of your state institutions, where the newer philosophy of a balance between natural, human, and social resources is promoted, and where the various disciplines are utilized in an integrated curriculum.

4. Urge and assist the Departments of Conservation in your state to expand and develop strong programs of adult education geared to helping solve community and state problems and to the improvement of living, and not just restricted to the production of more birds to shoot and more trees to cut.

5. Urge and assist with the various means of getting professional conservationists, members of all the various professional and scientific groups, to work and plan together on common objectives, rather than fight and compete in order to do the job alone.

6. Aid in getting a greater acceptance on the part of educators of the responsibility for conservation and resource-use education programs, and decrease the emphasis in trying to do it ourselves because educators will not undertake it. Cooperate with Teacher Training Institutions and Schools of Education and State Departments of Education. Try to understand their problems, their newer techniques of teaching and concepts of learning, and avoid criticism born of ignorance, lack of understanding of curriculum change, or impatience at the speed of the transfer of responsibility.

7. Continue to give every bit of professional help, as you have been doing, in interpreting the results of research, the intricacies of sound management plans, and the like. Help educate the educator and win his respect by cooperation and the use of the newer tools of communication, and avoid unnecessary criticism and foot-dragging, when they try to undertake their responsibility.

8. Continue to help influence our national and state government leaders in the understanding of our rich heritage of leadership in conservation, and in the soundness of many of these excellent programs built to meet specific and important needs of our people, and to avoid any hasty, ill-conceived and administered curtailment programs which demoralize significant groups of devoted and trained conservationists and forces them to seek employment in other fields. Let's not nullify the conservation gains we have made over these fifty years, turning our resources back to those selfish individuals and groups who place "private gain above public good" in the guise of free enterprise and democratic government.

9. Let's try to develop a sound philosophy of resource-use, which is not as conflicting as the one which can justify demands of states such as Texas and California for water from Arizona and New Mexico, and at the same time refuse them a share of the off-shore oil resources.

10. Let's find ways of working together to promote and execute a program of resource-use for all peoples utilizing the assistance of all who can and want to contribute.

Immunity On Nature's Terms

J. DAVID LARSON

This article, describing the mechanism of immunity of crops to insect and disease attack, is designed to stimulate interest in the subject as an indispensable phase of Conservation.

If the restoration of topsoil to its pristine state of fertility, thus "getting back to virgin soil principles," creates an environment inhospitable to insects and disease, then such restoration is the veriest Conservation. In its most basic sense, it involves a "return to Nature," the production of a man-made virgin soil and its intelligent application.

Applied on a nation-wide scale, results would demonstrate that immunity is an incontrovertible fact, and thus relegate terms such as "fantastic," and "incredible" to the limbo of forgotten things.

"YOUR CLAIM that for years you have grown crops immune to insect and disease attack is so fantastic as to be incredible!" With undisguised astonishment the agricultural research executive listened as we unfolded our experiences in the field of natural immunity. He learned that what he had been convinced was an impossible achievement, was for us a commonplace event. Needless to say, there is ample ground for his scepticism. Registered with the United States Department of Agriculture are some 45,000 so-called "economic poisons," each a specific for a certain insect, but innocuous to a closely related pest. In the *1952 Year Book on Insects,* is the statement that pests cost four billion dollars a year to combat. And Dr. Cynthia Wescott, plant pathologist, declares that plant diseases cost every man, woman and child in the United States $120.00 annually, an amount adding up to the tidy sum of nineteen billion dollars! Simple arithmetic calculation indicates that each year we spend the huge total of twenty-three billion dollars to fight insects and plant disease.

Is anyone now living so naive as to suppose that posterity will regard our times as an age of intelligence, when eminent scientists, testifying before the Congressional Committee on Foods and Chemicals, have revealed that insecticide and herbicide residues in foods and in forage are shown to have deleterious effects upon human and on animal health?

On the other hand, is it too great a strain on the imagination to conceive of the possibility that insecticide residues in foods may be precluded, and that a large part of the staggering cost of poisonous chemicals could be saved by the simple expedient of applying new facts about soil management and plant metabolism to agriculture? It is safe to say that any fair-minded individual would agree that provided the principle of immunity could be demonstrated in a practical manner, on a nation-wide scale, this would be *Conservation,* indeed: conservation of human health by producing food free from insecticide contamination; conservation of soil productivity by avoidance of chemical residues in the topsoil from spraying and dusting operations.

Nutritionists, keenly alive to health hazards in food contamination by insecticide residues state — rather ruefully, it will be admitted — that unless lethal chemicals are employed to combat pests and disease, the human race must starve, implying that we are just one jump ahead of the bugs! As will be seen from the following, these well-meaning advocates of human nutrition stand in need of enlightenment about natural immunity of crops to insects and disease. Accordingly they will doubtless be astonished to learn of a phase of the food production picture other than chemical sprays and dusts for control of plant enemies. Unbelievers in such a *heretical* doctrine will immediately spring to attention and demand — rightly so — full disclosure of these strange new facts. The answer involves a lengthy story of unheralded research and observation of natural phenomena, including a unique interpretation of such phenomena from the viewpoint of an engineer rather than that of the orthodox biologist.

Early Observations of Unique Phenomena

More than a quarter-century ago a health problem necessitated my giving up a promising engineering career, with the hope that help might be found in work on the family farm in northern Wisconsin. Here was opportunity for health restoration and for a critical observation of certain agricultural phenomena then merely taken for granted, or ignored. Hardwood timber land was being cleared for cultivation with results that amazed me. Although hardly an *embryonic* conservationist I saw, with consternation, as the primeval forest was cut down, that streams dried up! In the shade provided by standing trees, the ground remained permanently moist, and characterized by a luxuriant ground cover. Although ours was primarily a clover-and-timothy grassland farm, we grew a modest quantity of small

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The raw materials for producing Normal Soil are handled by a 2-ton capacity bucket crane.

grain, and where such "clean cultivation" was practiced on that rolling land, the topsoil lost its water-holding properties, with formation of small gullies. Despite such demonstration of the aftermath of forest destruction, the urgent need for tillable land, for dairying activities, seemed to justify the wholesale destruction of the forest.

Crops planted on newly cleared land — potatoes, tomatoes, cabbages, etc. — yielded luxuriantly, were of delicious flavor, and completely free from insect attack and plant disease! The second year, however, vegetation on these cultivated plots was attacked both by disease and by insects, yet, strangely enough, the same type of crops planted on newly cleared land immediately adjacent, grew unmolested. Repeated year after year, this singular phenomenon was a never-failing accompaniment of the clearing of new land; always crop immunity during first year cultivation of that virgin soil, invariably insects and disease took over by the second and succeeding years!

How account for this striking immunity? True, exemption from enemy attack lasted but one season, yet so total, and absolute was the immunity that here was something that could not be blinked; a fact that had to be reckoned with. Farm advisors, county agents, and practical farmers were questioned, with no rational explanation forthcoming. The general reaction seemed to be that this was a new country, where bugs had not had time to lay their eggs. As for plant disease not affecting first-year crops, a curt shrug of the shoulders disposed of that query. Failing to get an explanation from agricultural authorities or from practical farmers, the solution obviously devolved upon myself. To an engineer, the problem was theoretically susceptible of solution; solvable by resort to thinking in terms of causation. Time has vindicated that thesis.

As any biological scientist might surmise the answer to so complex and mystifying an anomaly was not found full-blown. Years of patient exploration of the subject were involved; the accretion of fact upon fact—along with the rather disconcerting realization that certain time-honored traditions were found vulnerable to critical examination and not nearly as fool-proof or incontrovertible as would be implied by their acceptance by scientists. In this mixture of old and new facts and more precise data on biology, was found the answer. The clue to the short-lived immunity exhibited by initial crops on the family farm many years ago was inextricably tied in with the ultimate solution to the problem of *permanent immunity!*

The Problem of Virgin Soil Production

Among phenomena of which I was an eager and profoundly interested observer was that of Nature's actual production of virgin soil, itself. This interest inevitably involved the relation of soil minerals and organic matter, critical proportions of the respective components, and the stabilization of soil aggregates. Subsequently, other factors, such as the role of major and trace elements, the mechanism of uptake of plant nutrients, water-holding properties, prevention of leaching, and capillarity, were to come under close scrutiny during the years that followed. Vividly I recall, many years ago, when on the observation platform of a train passing through the Rockies, a traveling companion pointing to great hollows in granite and porphyry cliffs. "Can you guess how those big gaps were made in these rocks?" he asked. "It was done by erosion." This impressive evidence of the mechanical effect of atmospheric forces was observed long before Soil Conservation became a household word; when *erosion* was a term strictly limited to geologic phenomena! Nevertheless, witnessing the disintegrating effect upon solid rock by heat, cold, wind, precipitation and other forces, was a never-to-be-forgotten experience. Doubtless it contributed to my consideration of the manner in which virgin soil was derived from primitive rocks through centuries of decomposition and the gradual incorporation of organic matter with the decomposed mineral. Granted that this

A graphic demonstration. Left—A heavy clay topsoil as usually found. Right—After Normal Soil was added as a conditioner.

was Nature's mode of producing virgin soil, wherein lay the secret of the one-year immunity as observed on the family farm?

Eventual solution of the problem resolved itself into the tentative conclusion that in virgin soil Nature had provided some obscure factor, or perhaps a combination of agents; an unknown combination that obviously lost its magic influence with the harvest of the initial crop. What, then, was this elusive combination, and why was its efficacy limited to but a single season? Answers to these searching queries were to come partly from seemingly irrelevant sources and events in ordinary farm routine, and partly from persistent research and reflection. In the early years on this pioneer farm our livestock was distinguished by absence of disease. No tuberculosis, mastitis, Bangs Disease, or other common ailments were in evidence. Despite the torment of deer flies in summer, our more or less contented cows gave heavy yields of superbly flavored milk. Primarily a grassland farm, the excellent quality of beef produced from grazing virgin land forage crops, alternating with wild grass meadow pasturage, will long be remembered. Uniformly healthy were chickens and hogs. Poultry diseases, hog cholera and intestinal worms were conspicuous by their absence.

Despite violent rainstorms during those initial years, no lodging of small grain, or timothy, clover or other forage and hay crops occurred, prior to our efforts to conduct farm operations *scientifically,* by conforming to authoritative discoveries in soil management. One example will suffice. From authentic sources we learned that barnyard manure, to prevent loss of valuable nitrogen, should be hauled out on the field and spread when fresh. Crop yield was perceptibly increased by the practice. Unfortunately, soon afterward we were plagued, after each rain shower, by the lodging of all forage and hay crops, including small grain! Again, in winter it was noticeable that the cattle sniffed gingerly at the hay in their mangers—clover and timothy so well fertilized with fresh barnyard manure during the previous season—scattering and trampling under foot more than they ate. More singular was their behavior when loafing in the barnyard in mild weather. Instead of concentrating on clover and timothy in the feeding racks, the cows eagerly resorted to wild meadow hay stacked for use as bedding! Here was a concrete demonstration that the instinct of dumb beasts was superior to alleged scientific advances in soil management. The peculiar behavior of our dairy herd was a source of profound speculation. Years of research in organic chemistry were required to yield a rational explanation for their singular preference for wild hay and obvious disdain of what we assumed was highly nutritious clover and timothy.

Now that the basic facts are available, the explanation is relatively simple. When acting on the advice of agricultural experts to spread fresh, nitrogen-rich manure on our fields, we did not at the time realize (nor did the experts) that nitrogen stimulates crop yield at the expense of mineral nutrient uptake. Nitrogen of the fresh manure, combining tenaciously with carbon of the cellulose structure of the crop, encouraged excessive vegetative growth, resulting in extreme lengthening of the

A field of potatoes growing in Normal Soil—immune to insects and disease. No spraying or dusting used.

internodes. Lodging of small grain and hay crops was due to a partial inihibtion of mineral absorption with weakening of the stalk and an unpalatable flavor of the fodder. Thus it is seen that our cows were more "scientific" than we were!

It is pertinent to remark that in spite of general currency of facts such as cited in the foregoing, many farmers today persist in the application of excess nitrogen to their soil, failing to see the connection between lodged grain, susceptibility to disease, and other problems, and such irrational soil management. The question should therefore be timely: Should not the time-honored, accepted tradition that crops (other than legumes) are unable to absorb atmospheric nitrogen through their foliage, be re-examined? It goes without saying that when re-appraising this venerable hypothesis, a re-orientation of soil management practices should likewise follow. That is to say, a return to virgin soil principles would be necessary if significant new facts may be expected.

Experiences such as recounted in the foregoing indicate why I felt warranted in assuming that the obscure combination of factors in virgin soil comprised a critical proportion of all soil components; that in producing normal virgin soil Nature employed materials which, in the long course of time, yielded humus characterized by such critical proportion of all nutrient elements. One other consideration was not to be overlooked: the finished product, virgin soil, was an *organic* material, to the extent of 100 per cent. That is to say, virgin soil is more than a mere mixture of inorganic minerals and organic matter. It is *live* material, one in which the so-called *inorganic* minerals have been transformed into an activated state. As such, all minerals are totally available to the growing crop.

Stockpile of Normal Soil remains friable despite exposure to all kinds of weather.

Explanation of Transitory Immunity

Upon such total assimilation of mineral nutrients — and upon their presence in critical proportions in virgin soil—seemed to rest a rational explanation of the transitory immunity observed on the family farm. If this premise were correct, it should be demonstrable in fact. To be solved, then, was the problem of practical application of the theory. What could be more practical than to imitate Nature in the production of a virgin soil? The igneous rocks, obviously the origin of all soil, could be disintegrated mechanically and composted, for the interminably slow decomposition of primitive rock by Nature was analogous to slow motion composting. The first obstacle to be hurdled was the determination of a pattern, a standard to which a normal virgin soil should be produced. Thousands of soil types as classified by scientists only created a hopeless confusion. Nature, herself, showed the way out of this dilemma by pointing to virgin soil produced from porphyritic rocks in the West and from granite in the East, where the soil remained undisturbed from the beginning. Here was a pattern to be imitated in producing an artificial virgin soil. Chemical analysis showed that the parent rocks contained not only major components but a large number of trace elements. The role of the latter was at first not clear, but subsequent research revealed their essential role as catalysts for promoting the development and growth of vegetation.

Initially, three years were required to convert raw rock material into the humus state known as virgin soil. Rather primitive was the process through which this result was achieved; a process which a scientist friend called "a glorified composting project." Production of substantial quantities of Normal Soil, as we termed our product, soon enabled us to demonstrate that immunity to insects and to disease could be extended year after

A field from which Canadian thistle, bindweed, and quack grass disappeared spontaneously after application of Normal Soil.

year; that it was not limited to a single season. In marked contrast to the virgin soil of the family farm, we selected a plot of ground virtually eroded of topsoil, consisting of heavy clay subsoil. Saturating this impervious clay land with our man-made virgin soil, we found that the crops grown became immune to their natural enemies. This was no question of isolation, as the land had been farmed for a century. In the immediate vicinity was land under conventional cultivation, with the inevitable plague of insects and disease. In this environment was our significant Normal Soil enterprise situated, where for several years we performed feats that defied all the rules of scientific soil management. In addition to demonstrating that food crops could be grown year after year without resorting to chemical sprays and dusts, immune to pests and disease, we grew various crops on the same plot of ground without rotation. Instead of developing disease, the yield and the quality of crops increased year after year.

Weed Control and Soil Conditioning Results

Unexpected by-products of our immunity demonstration were observed as Canadian Thistle, bindweed, quack grass, and other noxious weeds automatically disappeared with the *normalizing* of the heavy clay land by adequate application of our Normal Soil! The heavy clay became porous and friable, and tillable in most all weather, a result that was as amazing to us as it was unexpected. As might be surmised, the improved tilth contributed to increase the crop production.

The economic and technical significance of our manysided achievement made it imperative that we lift our Normal Soil program out of the realm of empiricism; that we support our demonstration of immunity with facts based on organic and biochemistry. Quite as pioneering as the development of our man-made virgin soil was this concept that immunity as well as susceptibility to pests and disease could be explained in terms of organic and biochemistry. The scope of researches in this field involved a new approach to biochemistry of metabolism; a re-appraisal of traditional concepts of fungus disease and plant pathology as a whole; and a re-orientation with respect to the origination and development of insects and parasites. Briefly, an accurate and comprehensive explanation of phenomena of *natural immunity* necessarily embodies the consideration of new facts and more precise data in fields of soil science, biochemistry, plant pathology, and entomology —not to mention its impact on insecticide chemistry, biology and certain aspects of the perennially new theory of evolution. Not less important than the foregoing is the stimulus which our approach to scientific thought should give to a serious consideration of the *Life Principle* operative in all living things. For we hold that living matter, per se, does not consist of *living substance* as an independent entity, but rather it is *living* because through it is exhibited the *Life Principle*. Further, *Life*, or the *Life Principle*, exhibits itself when there is the proper blend of physical material substance at hand. This, of course, is but another way of saying that *Life* exhibits itself when a critical proportion of specific elements is available for its manifestation.

Heretofore Science has been singularly diffident about discussing this vital aspect of natural phenomena. We submit that without candid consideration of the *Life Principle*, no genuine progress can be made respecting the specific cause of natural immunity.

Since this is neither a treatise on biochemistry nor on plant pathology, a discussion of technical details involved in natural immunity is beyond its scope. From substantial facts submitted it should be clear that the topic of immunity of crops to insects and disease may appropriately be considered as an important phase of conservation.

Soil Splash by Raindrop Impact on Bare Soils

BEN OSBORN

SOIL SPLASH has been described in a preceding paper (6) as an important factor of sheet erosion. The extent to which the effects of raindrop energy are avoided by the interception of the drops by cover on the land profoundly affects the total erosional damages from rainstorms.

A field evaluation of the effectiveness of range and cropland cover in preventing soil erosion, conducted by the Operations and Research branches of the Soil Conservation Service in the Western Gulf Region, included measurements of soil splashed from bare plots and the determination of the relative susceptibilities of different soils to detachment by drop impact. This paper reports results of this phase of the evalutations.

Any form of erosion consists of two sequential steps: (1) detachment and initiation of movement of the soil particles, and (2) their removal or transportation from the points of detachment (2). The principal effect of raindrops striking the soil is the detachment of soil particles, making them available for transportation by surface flow, if any is present. Surface flow is especially efficient in transporting the detached materials, since it operates in a horizontal plane and in a single direction as contrasted to raindrops, which strike vertically and splash soil in all directions.

It is when the complicated forces of falling raindrops and flowing water are teamed up that maximum erosion damage occurs. If the effects of the first can be neutralized, the effectiveness of the team is diminished accordingly. This paper is concerned only with the first of these forces.

In the absence of cover, the amount of soil detached in any situation is a function of the *detaching capacity* of the rain (or of water artificially applied) and the *detachability* of the soil. In these evaluations, the mobile raindrop applicator described in the preceding article was used to apply water of standardized impact to field plots with and without cover, and to soil samples for determining relative detachability. The standard test application was two inches of water in 20 minutes, with a detaching capacity of 110,000 pounds per acre, approximately equivalent to a hard spring thundershower.

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Detachability of the Soil

The character of the soil itself greatly influences the amount of erosion caused by a rain. The susceptibility of soils to erosion is an extremely variable characteristic, which must be taken into account in evaluating the effects of cover on the ground or in deciding upon cover requirements for effective conservation.

Detachability of the soil was determined from cores of the upper 2-inch layer of soil taken to match as exactly as possible the surface conditions within the plots to which the water was applied (figure 1). Three cores in undisturbed field condition were taken to represent each plot, and two others were oven-dried and pulverized to a standard mechanical condition.

These cores were placed on a turntable beneath the raindrop applicator and subjected to the standard application of water along with samples of a standard sand of high and uniform detachability (figure 2). The susceptibility of the soil to detachment was shown by the amount splashed from each sample in comparison with the amount splashed from the sand. This rate was expressed as a percentage, the splash from the sand being 100 per cent.

The average detachability rates of the natural cores was used in calculating effectiveness of cover. Detachability of bare plots was calculated directly from the measurements of the soil splashed from the plots.

Factors Affecting Detachability

Early investigations of rainfall energy showed that soil properties influence erodibility (2). Ellison stated these relations as follows (3): "Detachability may vary with (a) cohesive properties of a soil, (b) shape of particles that may affect their interlocking, (c) distribution of particle sizes that affect their interlocking, (d) sizes of particles as this may affect the smoothness of the surface that is exposed, (e) chemical properties of the soil, (f) biological conditioning of the soil, and (g) physical condition of the soil."

Other experiments showed that detachability of the same soil varied with its structural condition (7), and that pulverizing a soil greatly increased its susceptibility to raindrop action.

In general, these tests confirm the earlier findings. The factors affecting detachability may be summarized as: (1) Permanent characteristics of the soil unit, including size and shape of particles; and (2) soil conditions which are subject to change, such as structure, size and

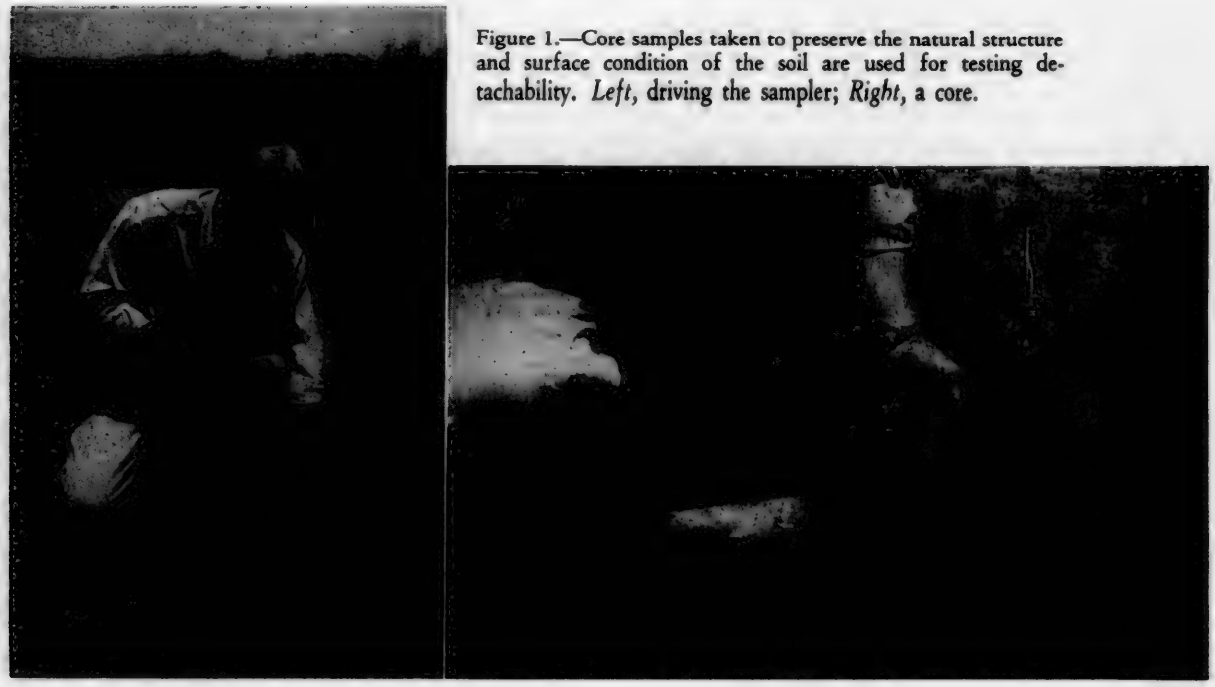

Figure 1.—Core samples taken to preserve the natural structure and surface condition of the soil are used for testing detachability. *Left,* driving the sampler; *Right,* a core.

character of aggregates, and various influences of plant and animal life. Current land use and management is a predominant influence on conditions of the soil that affect detachability.

Effect of Land Use. Under field conditions, detachability of cropland soils averaged much higher than the detachability of range and pasture lands (table 1). The average detachability rate for 103 plots in cultivated fields was 70 per cent, whereas for 121 plots on the same soils in ranges, meadows, and pastures it was 49 per cent. In contrast, average rates for pulverized soils from both croplands and ranges were practically the same, 74 per cent and 75 per cent, respectively.

The average detachability of cropland soils in field condition, 70 per cent, was about the same as that of rangeland soils which had been pulverized, 75 per cent. The maximum detachability rate of range soils in field condition, 79 per cent, was only slightly higher than the average of the same soils when cultivated, 70 per cent. This suggests that the detachability rate of a soil determined from pulverized samples might be used as an indication of its susceptibility to splash erosion when cultivated, and of its maximum detachability when in range, meadow or pasture.

However, the extreme variation in detachability, even of the same soil in the same land use, makes average rates of little value in predicting erosion hazards under field conditions. Many more measurements under a variety of field conditions are needed to determine for each soil the highest rate that occurs frequently enough to be given consideration in planning the amount of protection needed at each season. Present information indicates that, in order to provide adequate protection for most fields and pastures, cover would need to be provided to offset rates of erodibility somewhat higher than the average in each case.

Soil Unit. Ellison (2) has stated that, in general, soils rank in the following decreasing order of detachability: sands, silts, and clays. An examination of published measurements (3, 7), however, does not show any consistent relationship between this characteristic and mechanical analysis. None of these reports takes into consideration the shape of soil particles, which may have an important bearing on erodibility.

When the soil units included in these evaluations were arranged in a series according to texture, from fine to coarse, and the average detachability rates compared (table 1), there was an evident tendency toward low detachability in the medium-textured soils and those with a high silt fraction, whereas high detachability rates were prevalent in both very fine-textured soils (clays and clay loams) and coarse-textured soils (sands). Observations during the tests suggested that the approximately equal proportions of different-sized particles in the loams, or high proportions of medium-sized particles (silt), may be favorable to cementing or compaction which makes the soil resistant to detachment.

Because of marked exceptions to this trend, it does

Figure 2.—Soil samples are subjected to a test application of water beneath raindrop applicator, in comparison to standard sand (*extereme left*). The turntable revolves during the test to assure that every sample receives the same drop impact. Note difference in amount of soil splashed from the four samples of the same soil unit.

not seem from present information that texture can be used as a reliable indicator of the probable detachability of a soil. An examination of the rates of individual samples shows a wider variation within most soil units than between the averages for different units, suggesting that changing conditions in a soil may have more influence on its detachability at any particular time than its permanent characteristics.

Soil conditions. Detachability rates of natural cores varied more than those of pulverized samples, as is shown even in the averages for different soils in table 1. This indicates that structure, organic matter, and possibly other influences of plant and animal life in the soil affect its detachability.

Organic matter content and volume-weight were determined from core samples representing each plot tested. Average values for the surface two inches, which was the portion used in detachability tests, are shown in tables 2 and 3.

Wide ranges in both these values were found in range and pasture lands of every soil unit tested, indicating differences in soil condition associated with the past use and present condition of the cover. In general, these conditions were increasingly unfavorable with successively lower range condition classes; i.e., organic matter contents were lower and volume-weights higher. Differences in detachability rates, water intake, and moisture-holding capabilities were found in almost every site.

When plots of the same site were grouped by range condition classes and their detachability rates averaged, marked differences were found which usually followed definite trends related to range condition. The directions of these trends were not the same, even in soils of similar texture. Although some of the trends, when considered separately, could be explained by observed structural or other conditions, present information does not provide a basis for predicting detachability rates for different combinations of soil unit and range condition.

In every soil unit tested, average organic matter content of cultivated soils was appreciably lower than for range lands in "poor" condition, and much lower than the average for range lands. The variation in organic matter content of croplands was consistently less than for corresponding range lands. Insofar as organic matter reflects desirable conditions in a soil, croplands of each soil unit were uniformly depleted to a lower level than "poor" condition ranges.

Table 1.—Detachability of soils as measured by artificial rainfall test.

Soil Unit and Land Use	No. of Plots	Pulverized Soil Avg. (Min.-Max.)			Natural Cores Avg. (Min.-Max.)		
		%	%	%	%	%	%
Clays and Clay Loams							
Blackland, 2[1]							
Cropland	21	77	(64-98)		62	(30[2]-98)	
Meadows	13	79	(68-95)		55	(47-72)	
Pastures	16	82	(68-93)		51	(22-79)	
Trans-Pecos, 2							
Range	5	62	(54-78)		51	(20-76)	
Edwards Plateau, 2							
Cropland	26	74	(61-90)		69	(48-110[2])	
Range	18	60	(48-83)		44	(22-64)	
Grand Prairie, 2							
Cropland	21	90	(63-102)		73	(58-101)	
Range	22	86	(60-102)		57	(17-77)	
Rolling Red Plains, 2							
Cropland	16	63	(54-74)		75	(37-122[2])	
Range	5	62	(53-70)		53	(30-73)	
Trans-pecos, 2X							
Range	11	58	(38-88)		41	(14-63)	
Silty Loams							
Rolling Red Plains, 5							
Range	12	50	(32-78)		31	(10-53)	
Rolling Red Plains, 24							
Range	15	58	(43-77)		37	(12-79)	
Sandy Loams							
Cross Timbers, 6							
Cropland	11	57	(46-66)		90	(45[2]-205[2])	
Oldfield pastures	13	71	(62-86)		33	(4-79)	
Wooded pastures	11	59	(54-65)		46	(11-70)	
Cross Timbers, 19							
Range	23	81	(58-116)		46	(10-93)	
Rolling Red Plains, 7							
Cropland	8	66	(60-70)		65	(47-79)	
Rio Grande Plain, 7							
Range	9	63	(56-76)		23	(6-48)	
Trans-Pecos, 7							
Range	8	84	(67-102)		77	(63-106)	
High Plains, 7X							
Range	23	83	(72[2]-100)		55	(20-94[2])	
Sands							
Rolling Red Plains, 12							
Range	8	86	(81-94)		76	(57-102[2])	
All Soils							
Cropland	130	74	(46-102)		70	(30-205)	
Range, pasture, etc.	121	75	(32-116)		49	(4-106)	

[1]Numbers refer to soil units as classified in soil conservation farm planning surveys.
[2]Based on soil splashed from bare plot.

Table 2.—Average organic matter content of surface two inches of soil.

Site (Area & Soil Unit)	Range and Pasture					All Conditions	Croplands
	Excellent	Good	Fair	Poor	Bare		
	%	%	%	%	%	%	%
Clays and Clay Loams							
Blackland 2	7.62[1]	3.89[2]		4.34[3]	3.01	5.24	2.17
Trans-Pecos 2			2.52	1.12	1.99	2.13	
Edwards Plateau 2		4.26	4.54	3.38	3.14	3.84	2.51
Grand Prairie 2	6.16	6.70	4.39	5.04		5.63	3.23
Rolling Red Plains 2		4.92	3.24		3.37	4.28	1.69
Trans-Pecos 2X			3.54	2.19	1.32	2.15	
Silty Loams							
Rolling Red Plains 5			3.82	2.29	2.12	2.91	
Rolling Red Plains 24	2.37	2.57	2.57	1.16	1.26	1.95	
Sandy Loams							
Cross Timbers 6			1.85[4]	1.07[5]	1.20	1.39	1.04
Cross Timbers 19	1.93	1.88	1.81	1.12	1.79	1.71	
Rolling Red Plains 7							1.48
Rio Grande Plain 7			1.15	.85	.82	.91	
Trans-Pecos 7			.95	.81	.75	.86	
High Plains 7X		1.31	1.03	.88	.77	1.03	
Sands							
Rolling Red Plains 12	1.43	.89	1.74	1.52	.99	1.34	

[1]Native meadows.
[2]Reestablished meadows.
[3]Farm pastures.
[4]Wooded pastures.
[5]Old fields.

On the other hand, volume-weights of cropland soils sometimes were comparable to those of "excellent" condition range. On most sites, the density of the soil increased progressively as organic matter declined in each lower range condition class. But in croplands, no consistent relationship was found between volume-weight and organic matter content. Volume-weights of cultivated soils varied widely, usually covering the entire range of variation for the soil unit in all land uses.

Tillage obviously caused much of this variation in density of cropland soils by restoring non-capillary pore space to soils which otherwise would have been compacted. It should be kept in mind that the volume-weights were determined from samples of the surface 2 inches, taken in a manner to preserve non-capillary pore space in the volume of the soil.

When average detachability rates of the soil units were plotted against average organic matter content and volume-weights of each, no well-defined trends were evident. In general, high detachability rates were associated with high organic matter content and low volume-weights, indicating favorable soil conditions. But at the opposite extremes found in "poor" range condition class and in croplands, both high and low detachability rates were found.

On range lands, surface crusts formed on exposed soils by algae, molds, lichens, mosses, or other low forms of plant life, greatly reduced detachability where they occurred (figure 3). Ecologists have long recognized the

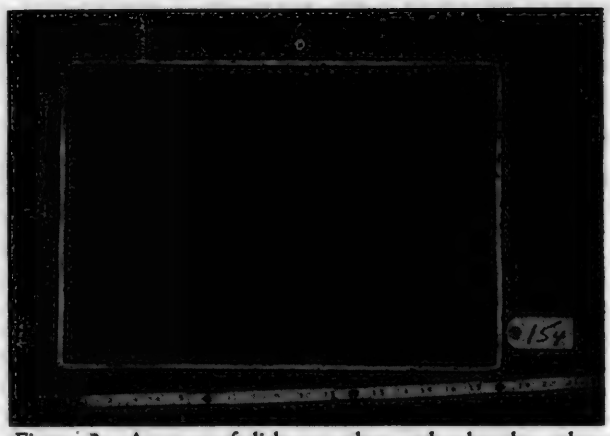

Figure 3.—A crust of lichens, aglae, and other low plant forms frequently covers exposed soil on depleted ranges, reducing susceptibility to splash.

importance of such growths in stabilizing soil in the early stages of plant succession. Booth (1) described the effects of three types of algal crusts on eroded soils of Texas and Oklahoma in "binding the surface particles of soil into a non-erosible layer which is also very effective in breaking the force of falling water. Fletcher and Martin (5) reported crusts playing a similar role on red desert soils in Arizona.

The effects of these crusts on soil movement was obvious on both field plots and natural cores (figure 4). Three special plots were selected on the same sample

Table 3.—Average volume-weights of surface two inches of soil.

Site (Area & Soil Unit)	Range and Pasture					All Conditions	Croplands
	Excellent	Good	Fair	Poor	Bare		
	%	%	%	%	%	%	%
Clays and Clay Loams							
Blackland 2	.88[1]	1.02[2]		1.14[3]	1.06	1.04	0.99
Trans-Pecos 2			.98	1.05	1.13	1.03	
Edwards Plateau 2		.86	.96	1.10	1.10	1.00	1.03
Grand Prairie 2	1.10	1.15	1.10	1.24		1.16	1.05
Rolling Red Plains 2		1.07	1.21		1.09	1.10	1.14
Trans-Pecos 2X			1.01	1.19	1.33	1.09	
Silty Loams							
Rolling Red Plains 5			1.12	1.30	1.38	1.24	
Rolling Red Plains 24	1.23	1.20	1.21	1.30	1.14	1.23	
Sandy Loams							
Cross Timbers 6			1.32[4]	1.39[5]	1.44	1.36	1.49
Cross Timbers 19	1.44	1.47	1.44	1.52	1.41	1.46	
Rolling Red Plains 7							1.23
Rio Grande Plain 7			1.53	1.52	1.53	1.52	
Trans-Pecos 7			1.44	1.42	1.48	1.44	
High Plains 7X		1.48	1.43	1.59	1.58	1.50	
Sands							
Rolling Red Plains 12	1.33	1.52	1.40	1.46	1.58	1.46	

[1]Native meadows.
[2]Reestablished meadows.
[3]Farm pastures.
[4]Wooded pastures.
[5]Old fields.

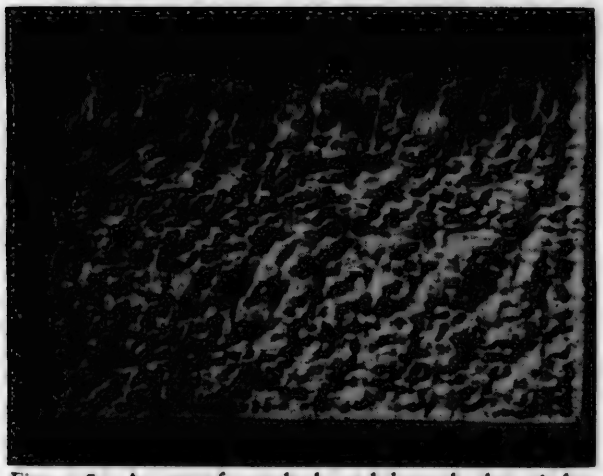

Figure 5.—A pan of standard sand beneath the raindrop applicator shows the detaching capacity of the test application of water and serves as a standard of comparison for interpreting results of field tests on soils. Pits in the sand after the test show the effects of individual drop impacts.

area on the Cross Timbers shallow sandy loam site to check the effects of crusts. One was covered with a thick mat of mosses and another with algae and lichens. The crust was carefully removed from the third plot nearby. The detachability rates of these plots were 13 per cent, 48 per cent and 93 per cent, respectively.

Although in a sense these crusts and growths of low plant forms might be considered a part of the cover, it appears impractical to measure them as such, or to attempt to manage them. It seems more feasible to regard them as a part of the soil condition, and to determine detachability rates to account for their influence on soil splash.

Such crusts are most prevalent under "poor" range condition where a large proportion of the soil surface is exposed to the direct sunlight. They undoubtedly account for the low average detachability rates of "poor" ranges on some sites. Tillage prevents their development on cropland.

The wide range in detachability of the cropland soils tested, and the fact that this characteristic is not plainly correlated with either soil type or condition, suggests that tillage plays a major role in the susceptibility of cultivated lands to erosion. Artificial physical conditions in the surface soil due to land preparation and cultivation largely obscure the effects of texture and natural structure.

Since most cultivated fields are subject to recurrent tillage during the year, it would seem advisable to plan conservation measures to offset the higher detachability rates shown in these tests.

Detachment From Bare Field Plots

Direct measurements were made of splash from bare soil on each site wherever natural bare areas large enough for the placement of a plot could be found. Locating plots was no problem in clean-tilled row crops. But in close-growing crops and on range land, a spot

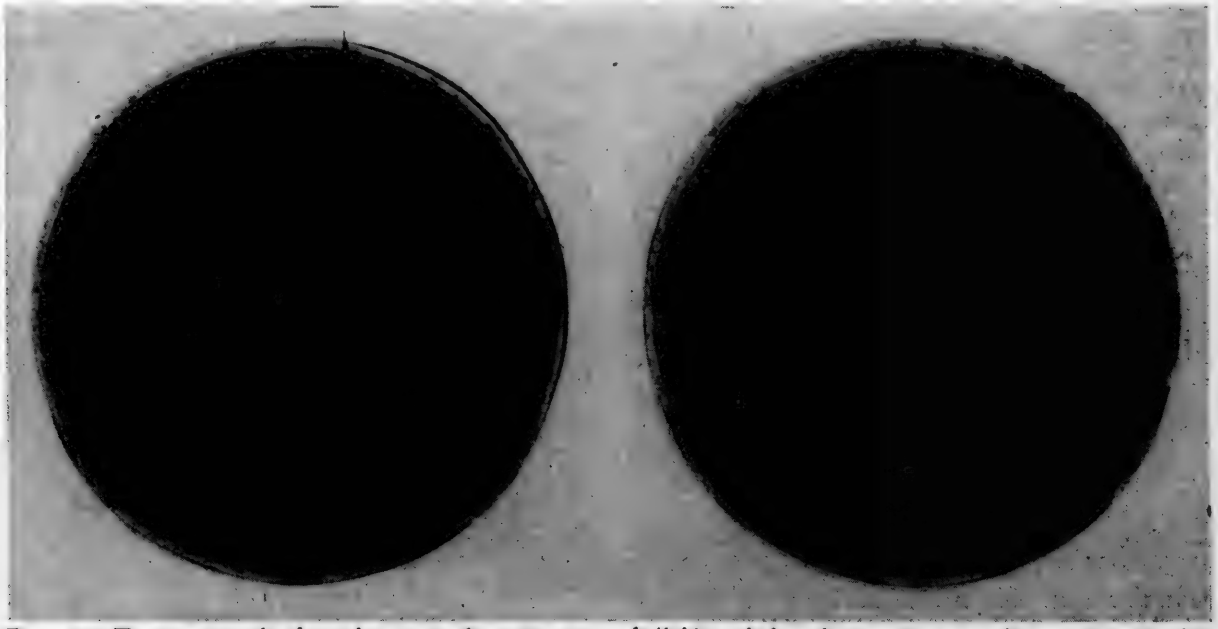

Figure 4.—Two core samples from the same soil unit, one crusted (*left*) and the other possessing good aggregation (*right*), differ widely in detachability. Splash from the two samples was 39 per cent and 73 per cent, respectively, of the standard sand.

completely devoid of cover into which a 12 x 18-inch plot could be fitted was an unusual find. Consequently, very few or no bare plots were tested on some sites.

Splash from naturally bare areas is a measure of their susceptibility to erosion under the field conditions represented. Splash from such plots does not reflect detachability of the same soils under various kinds of cover, however, because the soil surface conditions which affect detachability vary with different covers. For this reason, core samples taken from beneath each kind of cover were tested for detachability.

Measuring Detachment. The apparatus used with the raindrop applicator collected a sample of the splash from two sides of the plot. The soil was separated from the water and oven-dried. The weight of this soil did not represent the total detachment on the plot, however, because (1) it was collected from only two sides of the plot, and (2) some of the soil splashed from any point within the plot would come to rest again within its boundaries. Therefore, to determine the total detachment during a test, it was necessary to establish a ratio between the soil caught and the total detached (4).

This was done by running a series of tests with standard sand in a sampling frame the same size as the plot (figure 5), and comparing the sand that was caught with the calculated amount of detachment from an equivalent area as determined with standard 3½-inch cups, from which total detachment can be measured accurately (6).

For the early work on range land, the raindrop applicator was calibrated to a detaching capacity in the standard test of 123,590 pounds of standard sand per acre. The ratio between the portion caught in the two troughs and the total detached on the plot was established as 1/12.34. For the later work on croplands and farm pastures, the applicator was recalibrated to a detaching capacity of 110,000 pounds per acre, as previously described, and the ratio of splash caught to the total was 1/11.

Splash From Bare Plots

As might be expected from the detachability rates determined from the natural cores, splash from bare plots was consistently higher on croplands than on ranges and pastures (table 4).

Under the standard application of water, detachment from 22 individual plots on cropland ranged from 33,198 to 225,565 pounds per acre. On range and pasture land, the extremes on 28 plots were 8,832 and 160,339 pounds per acre. These represent the amounts of soil which would be available for removal by surface runoff under these same soil conditions during a rain of equivalent intensity and impact.

The plots which yielded maximum splash were those on which water accumulated on the surface during the tests because of low infiltration capacities, a condition which would be common during natural rains. It was repeatedly observed, on both core samples and field plots, that detachment increased whenever the soil surface was covered with water.

The minimum detachment from range plots was from soils having almost continuous algal or moss crusts.

(*Continued on page 43*)

Table 4.—Splash from bare soil. Averages for each soil unit and land use.

Site (Area and Soil Unit)	No. of plots	Measured on bare field plots		Calculated from detachability rates[1]	
		Splash	Detachability	Splash	Detachability
		Lb/Ac	%	Lb/Ac	%
Clays and Clay Loams					
Blackland, 2[2]					
Cropland	6	57,068	52	68,200	62
Meadows	2	52,622	47	60,500	55
Pastures				56,100	51
Trans-Pecos, 2					
Range	1	160,339	130	56,100	51
Edwards Plateau, 2					
Cropland	6	95,872	87	75,900	69
Range	2	31,946	26	48,400	44
Grand Prairie, 2					
Cropland	2	70,970	64	71,500	73
Range					
Rolling Red Plains, 2					
Cropland	5	112,490	102	82,500	75
Range	1	133,792	108	58,300	53
Trans-Pecos, 2X					
Range	2	76,572	62	45,100	41
Silty Loams					
Rolling Red Plains, 5					
Range	1	52,090	42	34,100	31
Rolling Red Plains, 24					
Range	2	62,396	51	40,700	37
Sandy Loams					
Cross Timbers, 6					
Cropland	4	126,063	114	99,000	90
Oilfield Pastures	3	18,425	17	36,300	33
Wooled Pastures	2	47,336	43	50,600	46
Cross Timbers, 19					
Range	4	47,736	39	50,600	46
Rolling Red Plains, 7					
Cropland	1	116,519	106	71,500	65
Rio Grande Plain, 7					
Range	1	26,931	22	25,300	23
Trans-Pecos, 7					
Range	2	76,860	62	84,700	77
High Plains, 7X					
Range	4	87,626	71	60,500	55
Sands					
Rolling Red Plains, 12					
Range	1	68,986	56	83,600	76
Standard Sand					
Cropland tests		110,000	100		
Range tests		123,590	100		

[1]Averages of cores from beneath all conditions of cover.
[2]Numbers refer to soil units as classified in farm planning soil conservation surveys.

Does Better Soil Management Pay?

HOWARD W. OTTOSON

TO CAST SOME LIGHT on this question a study has been conducted recently in two counties in northeastern Nebraska by the Nebraska Experiment Station. The objectives of this study were two-fold: First, *to ascertain the relationship between the systems of farming now used on farms in this area and their financial returns;* second, *to analyze the income possibilities of alternative crop and livestock systems, as well as the resource adjustments necessary with their adoption.*

There are many ways of farming any one particular farm. Each way involves various combinations of crops and livestock. Some crop combinations may be profitable for a few years, but they may bring about excessive soil losses with consequent decrease in farm income over a long period of years. An example might be a cash grain system on hilly land. On the other hand, in any area there are probably several systems of soil management which will satisfactorily control soil losses. Each system will require certain capital commitments, and will result in certain levels of annual costs. The returns from one system may vary greatly from those from a second. Any soil management system will produce certain quantities of grains and forages. With the production of these feeds farmers must decide how these best can be utilized. They must choose between selling them for cash and feeding them to livestock. If they choose to feed their home raised feed, they must further decide what kind of livestock they will keep.

Thus, it seems reasonable that the problem of soil erosion cannot be isolated by itself. Rather, the effects of soil erosion, as well as those of erosion control, involve the whole farm business.

For our basic information we selected a sample of thirty 160 acre farms in the Moody-Crofton soil association area of Dakota and Dixon counties, Nebraska. These farms were restricted to hilly land (none with more than ten acres of bottomland). From these farms detailed information was obtained concerning their crop acreages and production, livestock production, machinery and building investments, and incomes and expenses. Detailed soil maps were made of each farm.

We ranked the 30 farms as to the per cent of rotation cropland devoted to forage crops (legumes and nonlegumes) over a five-year period. For purposes of comparison we then divided the farms into two groups, which we called low-forage and high-forage farms. We did not consider the acreages of permanent pasture in ranking the farms; the two groups had about the same acreages of permanent pasture. The crop combinations, yields, and production for the two groups are shown in Table 1.

Table 1.—Land use and crop production[1]

	High-forage farms	Low-forage farms
Acres corn	58	66
Acres small grain	40	51
Total acres grain	98	117
Acres rotation hay and pasture	47	21
Acres permanent pasture	5	10
Other land	10	12
Total acres	160	160
Corn yield per acre	39	34
Oats yield per acre	31	26
Hay yield per acre	1.7	1.4
Feed units of grain per farm[2]	2,894	2,852
Feed units of forage per farm	1,135	922
Total feed units	4,029	3,774

[1]All acreages are five-year averages; yield and production figures are for 1950.

[2]A feed unit is the equivalent of a bushel of corn in feed value.

On the average the high-forage farms raised 25.9 acres more of rotation hay and pasture than the farms in the low-forage group. The low-forage farms raised 18.9 more acres of grain.

Crop yields were higher on the high-forage farms. They raised an average of five bushels more corn per acre than the low-forage farms. Actually, the variation in corn yields among the farms was wider than this. This is illustrated in Figure 1. For the farms as a whole, the range in yields between the lowest and highest farms on the forage scale was about 14 bushels. Oats and hay yields were also higher on the high-forage farms. Further, high-forage farms raised a greater total number of feed units of grain even though they had 19 fewer acres of grain, on the average. (One feed unit equals a bushel of corn in feed value.) In addition to this, they had more acres of forage and raised more feed units of

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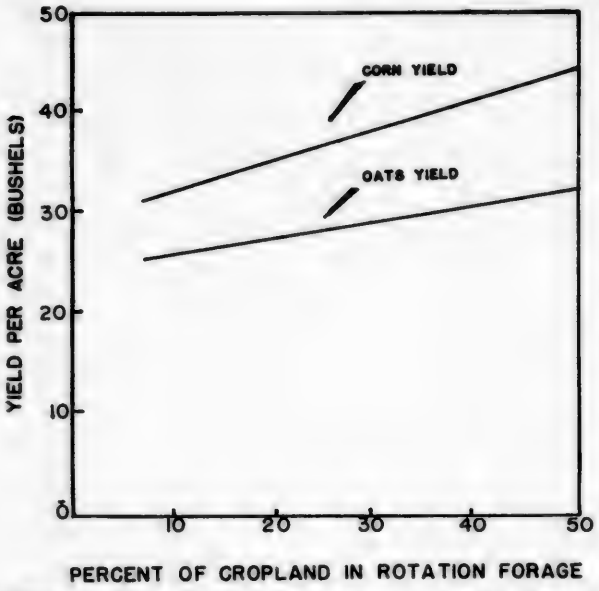

Figure 1.—Relationship between yields of corn and oats and the percentage of cropland in rotation forage, 1950.

forage. Altogether, they raised an average of 255 more units of feed in 1950 than the farms in the low-forage group.

The average production figures in the above table fail to show the important relationship between the number of acres of rotation forages and the total production of feed on these farms. As shown in Figure 2, as more and more of the cropland is used to grow forage crops, total feed production continued to increase until 30 to 35 per cent of the cropland was in forages. With more than 30 to 35 per cent of the cropland in rotation forages, the total production of feed was decreased.

We checked to see whether differences in soil resources caused part of the difference in yields and production; we found that there was no significant difference, statistically, in the acreages of the principal soils on the two groups of farms. Actually, the low-forage had a few more acres of the potentially more productive Judson and Moody soils than the high-forage group.

The differences in yields and crop production were not due to contouring and terracing, or to commercial fertilizers. On only two of the 30 farms were substantial acreages of land terraced and contoured in 1950. Practically no commercial fertilizers had been used up to that year. About the same acreages of first-year sweet-clover were plowed under on all of the farms.

Several factors probably contributed to the differences in crop yields and feed production between the high- and low-forage farms. First, the nitrogen added by a greater acreage of legumes on high-forage farms would increase grain yields. Second, the lower soil losses, with less washing away of plant nutrients, and fewer ditches, contributed to a higher production of feed. The annual loss of soil from erosion is estimated to be about 65 to 75 tons per acre on the low-forage farms, or an average of about 20 tons more than on the high forage farms. Finally, more feed was fed to livestock on the high-forage farms, and more manure was hauled back to the land.

How did the farms compare financially? In 1950 the high-forage farms had 51 per cent higher net returns on the average than the low-forage farms, as shown in Table 2. Here are some of the reasons for the higher income:

(1) The high-forage farms produced more feed than the low-forage group.

(2) A larger part of their grain was processed through livestock instead of being sold for cash. Some additional hay was even bought to feed the livestock.

(3) The type of livestock on these farms and the relationship of livestock prices to feed prices in 1950.

The low-forage farms raised more hogs ,and less roughage consuming livestock than did the high-forage farms. Unlike most years, 1950 prices for most forage-consuming livestock (except dairy products) were relatively higher than those for hogs,—resulting in an income aadvantage for forage-consuming livestock. By using the 1939-44 price level which more nearly reflects the usual relationship between forage-consuming and grain-consuming livestock, the difference in net income in favor of the high-forage group would have averaged $468 per farm.

To summarize, the high-forage group of farms was more profitably organized in the production and use of farm produced feeds than were the low-forage of farms. The high-forage managed farms to control soil losses at more nearly an acceptable level, but their financial advantage cannot be entirely and directly attributed to erosion control. However, to the extent that they controlled erosion, the high-forage group is assured of continued higher incomes in the future.

Even the high-forage farms might profitably reduce erosion further. In the second part of our study we analyzed the costs and returns of doing so by alternative methods.

There are several soil management systems by which soil losses may be held to a satisfactory level. Three specific systems were chosen for special study. These were:

Table 2.—Capital investment, labor and income (1950)

	High-forage farms	Low-forage farms
Investment in livestock	$ 3,711	$ 4,107
Investment in machinery	3,199	2,939
Investment in land and buildings	18,248	16,645
Months' labor used	15.0	17.1
Volume of business[1]	4,821	4,180
Net farm income[2]	2,469	1,635

[1]Sales plus inventory increases, less purchase of livestock and feed, and inventory decrease.
[2]Includes income to landlord.

a) A rotation containing sufficient grasses and legumes to control erosion without the aid of other soil erosion control practices.

b) A rotation of grasses and legumes plus row crops tilled on the contour and the use of terraces to control erosion.

c) A rotation of grasses and legumes, plus row crops tilled on the contour, the use of terraces, and the application of specified amounts of commercial fertilizers.

For brevity these systems will be called (a) R, (b) RTC, and (c) RTCF, respectively, in the rest of the discussion.

In order to determine the effects of the alternative soil management systems on farm income and expenses, six alternative crop rotations were studied. These were:

1) CCOs (Two years of corn followed by oats with sweet clover plowed under for green manure.
2) COs
3) COsCOMM (M=alfalfa-brome rotation hay or pasture)
4) COMM
5) COMMMM
6) M (Continuous hay or pasture)

These rotations vary from nearly all grain to continuous forage, with several combinations between these extremes. Yield estimates were made for each of these rotations, based on long-run weather conditions, as well as the assumptions that all of the feed would be fed on the farm, and all of the manure would be spread on the fields.[1]

Two criteria were used in selecting economically desirable rotations for each soil type under each of the alternative soil management systems. The first was soil loss per acre, annually. It was estimated by soil technicians that crop yields in the study area could be held at a satisfactory level over the years if the soil losses did not exceed seven tons per acre annually, on the average. Of course, it must be recognized that the soil loss will vary in individual years, depending on which of the crops of a rotation is being grown.

From the above list those rotations which would have an annual soil loss of less than seven tons per acre were selected for further analysis, under each of the soil management systems. To these was applied the second criterion, gross value per 100 acres of crop land, under the assumption that farmers are interested in the market value of their crops, even though they usually feed them to livestock. Of course, crop rotations giving the highest gross value per year would not necessarily be the most profitable combination if the production costs per acre for forage and grain were greatly different. However, it seems likely that the high-gross value rotations from these mentioned would also be those which would give the highest net value of crops per acre.

Generally speaking, the high-gross value rotations were those which produce the greatest total amount of grain per 100 acres of cropland, within the soil loss limits. Terracing and contouring enable farmers to use rotations having higher grain acreages and which produce greater quantities of grain, in the meantime still controlling erosion.

In contrast to the above, it should be noted that the rotations which ranked highest in total production of digestible nutrients generally contained greater proportions of hay and pasture than the rotations showing highest gross market value.

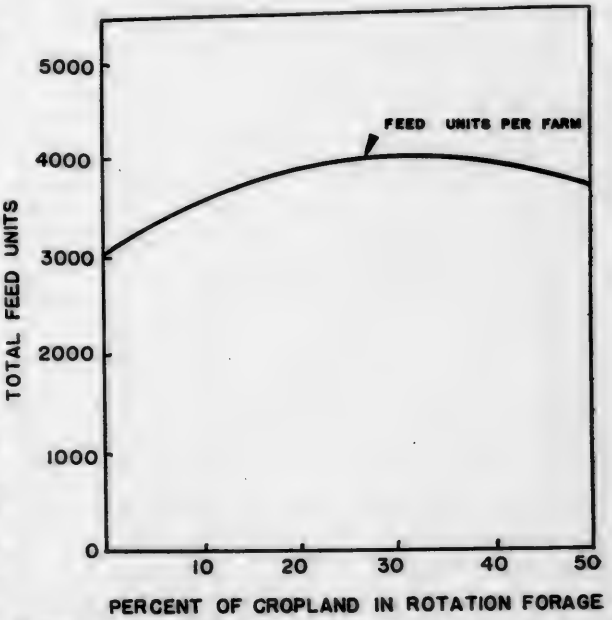

Figure 2.—Relationship between total feed units produced and the percentage of cropland in rotation forage, 1950.

[1]The yield estimates were prepared by A. R. Aandahl, Soil Survey, Soil Conservation Service, and H. F. Rhoades, Agronomy Department, University of Nebraska.

Table 3.—Land use, crop yields and production under present and alternative soil management systems.

Item	High-forage Farms				Low-forage Farms			
	Soil Management System				Soil Management System			
	Present System	R	RTC	RTCF	Present System	R	RTC	RTCF
Acres in row crops	57.9	10.2	43.2	52.6	65.9	13.6	46.3	55.5
Present rotation land in row crops	39.9	7.0	29.2	35.8	47.8	9.7	32.9	39.8
Acres small grains	39.7	10.2	39.0	41.5	50.6	13.6	41.0	41.1
Total grain acres	97.6	20.4	82.2	94.1	116.5	27.2	87.3	96.6
Per cent rotation land in all grains	67.3	13.8	55.5	64.0	84.4	19.3	62.0	69.3
Acres of hay and rotation pasture	47.4	127.2	65.7	52.9	21.5	113.4	53.3	42.8
Acres of permanent pasture	5.1	5.7	5.7	5.7	10.2	9.1	9.1	9.1
Corn yields per acre (bushels)	39.1	51.8	42.6	47.5	33.9	52.1	44.1	49.1
Oats yield per acre (bushels)	31.0	43.7	35.2	41.4	25.6	44.8	35.8	42.2
Hay yield per acre (tons)	1.7	.9	.9	1.6	1.4	1.0	.9	1.6
Total feed units of grain produced	2,894	756	2,577	3,378	2,852	1,011	2,787	3,611
Total feed units of forage produced[1]	1,135	2,580	1,430	1,909	922	2,574	1,249	1,666
Total feed units produced	4,029	3,336	4,007	5,286	3,774	3,585	4,037	5,278
Per cent of total feed produced as forage	28.1	77.4	35.6	36.1	24.4	71.8	30.9	31.5

[1]Includes rotation forage and permanent pasture.

With the selection of rotations for the various soils, the alternative soil changes in the use of land and in crop production which would take place on the sample farms if they adopted each of the alternative soil management systems are shown in Table 3. Holding soil losses to seven tons per acre by the use of soil management system R, which depends on rotations only to control erosion, would bring about rather extreme changes in the overall cropping systems. Even if the acceptable soil loss per acre had been assumed to be 15 tons per acre rather than seven tons, the grain acreages which could be raised would not be much larger than those shown.

With a soil management system including contouring and terracing the crop adjustments should be less extreme. Actually, some of the farms which originally were growing comparatively large acreages of forage could raise a few more acres of grain and still control erosion under soil management systems of rotation forage, contouring, and terracing (RTC), or rotation forage, contouring, terracing, and fertilizer (RTCF). This is shown more clearly in Figure 3.

The yields that are shown in Table 3 are overall farm averages. Grain yields would be considerably higher under system R because of the shifting of grain to the best land, as well as the increased grain yields brought about by having some forage in the rotation. More feed would be produced under system RTC than system R. The addition of an annual application of 1112 pounds of available phosphate and 1989 pounds of nitrate under system RTCF would produce an additional 1200 feed units per farm.

The adoption of the alternative soil management systems on the sample farms should involve additional capital investments, as well as increases in the annual charges. Estimates of these amounts, assuming 1950 prices, are shown in Table 4. For comparison, the change in the gross value of crop production under each of the alternative systems as compared to the system in

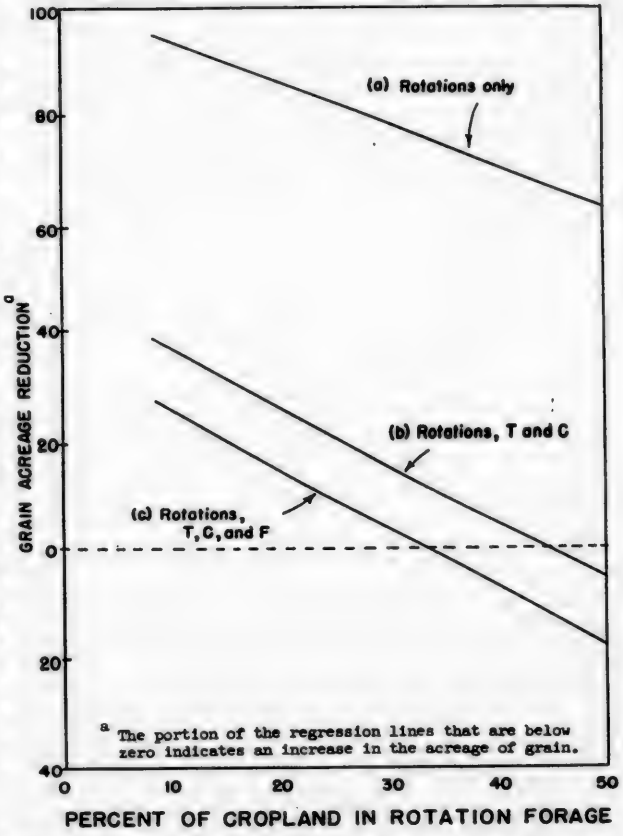

Figure 3.—Relationship between change in grain acreage and the percentage of cropland in rotation forage, 1950.

Table 4.—Capital Investment and Annual Charges on Alternative Soil Management Systems.

Items	High-forage farms			Low-forage farms		
	Soil Management Systems			Soil Management Systems		
	R	RTC	RTCF	R	RTC	RTCF
Capital investments						
Terraces	0	2,805	2,805	—	2,549	2,549
Waterways	64	64	64	59	59	59
Fencing	218	115	92	234	96	95
Additional feed storage						
Corn Crib	25	524	890	41	646	803
Small grain storage	3	81	150	5	74	117
Hay storage	3,235	1,300	2,150	2,839	988	1,570
Total	3,545	4,889	6,151	3,178	4,412	5,193
Annual charges						
Terraces and waterways	0	146	146	0	133	133
Fencing	16	9	7	18	7	7
Feed storage	166	97	163	147	87	127
Fertilizer	0	0	332	0	0	309
Seed, fuel and custom charges	164	338	373	132	337	3,300
Total	364	590	1,021	297	564	876
Change in gross value of crop	(2,075)[1]	(346)[1]	834	(1,071)[1]	120	1,166

[1] ( ) Indicates a decrease from 1950 system.

use in 1950 are shown at the bottom. Thus, a preliminary conclusion concerning the relative profitability of the three alternative systems can be drawn.

If our figures are reasonably correct, shifting to soil management systems R or RTC would result in a decrease in the net value of crop production on most of the sample farms, under 1950 price relationships. Even under system RTCF some of the high-forage farms would experience some decrease. Net gains would result on all of the low-forage farms, however. Further, by making this shift all of the operators would be assured of maintaining their production in the future, instead of experiencing diminished productivity due to soil deterioration.

Most of the feed produced on the sample farms is fed to livestock, and probably will continue to be so disposed of in the future. Therefore, a more conclusive analysis involves the estimation of the net returns for the farm as a whole from the utilization of the feed produced under the alternative soil management systems through several types of livestock. The profitability of the soil management systems would then depend not only on the total feed produced, but on the comparative efficiency of different kinds of livestock in using feed, as well as the relative prices for various livestock products.

Soil Splash by Raindrop Impact

(*Continued from page* 38)

The amount of soil splash which would occur in the absence of cover during a rain of given detaching capacity can be calculated from detachability rates of the soils in question, if they are known.

To illustrate the erosion hazards existing for exposed soil under the field conditions sampled, the average detachability rates for natural cores shown in table 1 are used to calculate the amount of soil movement which would be caused by raindrop action in a rain equivalent to the standard test. These results are shown in table 4 in comparison to the average amounts of splash measured from the bare plots tested under each condition. Since surface conditions of the same soil unit vary widely under different densities and conditions of cover, these average hazards would not be the same as those measured by the field plots on large bare areas.

Summary

Measurements of soil splash on bare plots of range and cropland revealed wide variations in the susceptibility of soils to movement by raindrop impact. In a standard test, with a raindrop applicator with a detaching capacity of 110,000 pounds per acre, soil movement by splash on 22 individual cropland plots ranged from 33,198 to 225,565 pounds of soil per acre. On range and pasture land, detachment on 28 bare plots ranged from 8,832 to 160,339 pounds per acre.

(*Continued on page* 49)

Young Outdoor Americans Building a Better Outdoor America

GRACE O. BEACH

Young Outdoor Americans will participate in a nation-wide conference in Chicago next March to plan more effective ways for youth to achieve greater results and contribute more toward both state and national programs of natural resource improvement and conservation in our country.

THE FORTHCOMING "Young Outdoor Americans" Conference is being sponsored by the Izaak Walton League of America in cooperation with state governors, and national, state and regional leaders of youth groups that have natural resource conservation as part of their regular programs. These youth groups are the 4-H Clubs, the Future Farmers of America, and Boy Scouts of America. Leaders of the Girl Scouts and Camp Fire Girls are cooperating in some areas.

Under the plan of operation, governors and their Young Outdoor Americans Committees are arranging state-wide conferences to which a number of young people who have shown leadership and intiative in resource improvement achievement, either in conjunction with the youth groups or by outstanding individual achievements, are invited to participate. Selected adults interested in this important work, including professional resource specialists, heads of major youth groups, state conservation leaders, and other interested civic leaders are also being invited to attend.

The state conferences being planned include discussions on such subjects as the principal natural resource conditions, problems and needs of the state; the type, scope and quality of resource conservation and improvement activities now being carried on by 'teen-age young people; the kinds and quality of guidance and assistance being given the young people by various organizations of adults to stimulate and encourage them to greater achievement, as well as ideas for improvement along these lines. Through these discussions the young people are being provided with background material to meet the young people from other states in the exchange and development of ideas at the national meeting.

During these state conferences the young people have a good chance to size each other up, and before adjournment choose the person from among their number whom they consider will best represent their state at the Young Outdoor Americans meeting in Chicago. The governors' committees were asked to summarize the results of the conference and the best answers to the questions discussed, and to send these to Chicago to be consolidated and incorporated into the program for discussion by the young people.

Attending the national conference in addition to the one young man or woman selected to represent each state are to be a number of delegates at large to assure balanced representation from the major youth groups. In addition, adult counselors from each group and recognized experts in various phases of conservation will be present and serve as advisers to the young people in their discussions.

It is planned there will be a general chairman of the Youth Conference, a person experienced in working with young people, whose principal task will be to see that the adults keep in the background and let the young folks run their show without interference or domination.

After the young people have carried out their deliberations and arrived at conclusions they will choose spokesmen from their number to present their findings and suggestions at the annual banquet of the Izaak Walton League of America national convention, the night of March 12.

The League program is being arranged so the young people might hear well known national conservationists give a "mountaintop" view of national conditions, problems and needs, to help the youngsters relate their state problems to those of the nation.

Following the national conference, the governors' committees are to meet again with the young people and adults who attended the initial state meetings to learn the results and evaluate the important points gained, so they may be applied by the young people and adult leaders in the various states in projecting and promoting resource development programs, and stimulating greater participation on the part of both young and old.

This is believed to be the first time an effort has been made to call together in one conference young people drawn from the major youth groups having resource conservation interest, for planning purposes.

The theme of the Chicago meeting will be "*Young Outdoor Americans, Building a Better Outdoor Amer-*

Mrs. Grace O. Beach is editor of Outdoor America, published by the Izaak Walton League of America. Her headquarters are in Chicago, Illinois.

ica." It is believed that from such annual conferences will come ideas for many fine new and different types of resource conservation and improvement projects that may be taken on by young people, wherever they may live, and suggestions to help show organizations of adults better, more effective ways to assist and stimulate them.

The program was designed by the League in cooperation with the leaders of the major youth groups, and public relations counsellors, with these ideas in mind. It is not an effort to organize a separate youth organization, but rather an unselfish desire on the part of the League to recognize the contribution being made by young people and to stimulate their efforts. The League has officially and specifically gone on record to that effect.

International Grassland Policy Resolution

This resolution on international grassland policy was presented by W. A. Minor, delegate from the United States and Chairman of the Steering Committee, to the Sixth International Grassland Conference, held at State College, Pennsylvania, August 17-23, 1952. The principles outlined in the resolution are far reaching in scope and have broad application in basic resource development and management programs.

Recognizing that

(1) Grassland agriculture is an important factor in maintaining prosperity of farmers, and increasing food production in a country,

(2) The scientific management of lands used for hay and pasture is essential for permanency and stability in agriculture,

(3) Correct grassland farming offers substantial insurance against soil deterioration, and results in an increase of water resources,

(4) A sound land management program depends on how well farmers, ranchers, and government manage their grassland.

(5) Improvement of grasslands is the basis for abundance in the production of meat and livestock products, and the continuous prosperity of these industries,

(6) Improvident management of grasslands has resulted in the ruin and extinction of prosperous agricultral communities in different parts of the world,

(7) The agricultural statistics in different countries with respect to grassland used for grazing are absent, incomplete, or lack uniformity, and give no estimation of output.

This Congress

(1) Brings to the notice of all countries the necessity for formulating a clear and comprehensive national grassland policy, consistent with the climatic, edaphic, and biotic factors of each, and with its economic, social, and industrial needs.

(2) Suggests that such a policy may, *inter alia*, provide, as far as possible, for

(a) Conducting research on genetics and breeding of grasses, ecology and physiology of grasslands, and suitability, palatability, and nutritional value of indigenous and exotic grasses under correct experimental procedure,

(b) Improvement and scientific management of range and pasture lands, whether owned by Government, states, corporations, and private or other agencies, by reseeding, rotational or deferred grazing, or by any other method suitable for the country.

(c) A survey, classification, and determination of ecological status and output of the existing grasslands of the nation,

(d) Economic production of correct grass seeds and their distribution,

(e) Improvement in the technique of harvesting and preservation of forage,

(f) Increased use of nutritious and palatable forage in livestock feeding,

(g) Imparting correct advice on improved grassland machinery,

(h) Proper management of grassland for soil and water conservation, and

(i) Collaboration and cooperation among all agencies in the country engaged in grassland work, towards a unified goal of preservation and improvement of grasslands, and

(3) Suggests that the Food and Agriculture Organization of the United Nations

(a) Consider the collection and dissemination of appropriate available data and material facts about grasslands in different countries, and

(b) That this consideration include the possibility of the development of a system of statistical enumeration for classification and output of grazing lands for use on an international basis.

Book Reviews

CHECKLIST OF NATIVE AND NATURALIZED TREES OF THE UNITED STATES (INCLUDING ALASKA). *By* ELBERT L. LITTLE, JR. *450 pp. Superintendent of Documents, Washington, D. C. 1953. $2.*

This is Agriculture Handbook No. 41, Forest Service, U.S. Dept. Agric., and was prepared under the direction of the Forest Service Tree and Range Plant Name Committee consisting of William A. Dayton, Raymond D. Garver, Bert R. Lexon, and Lawrence W. Smith, in addition to the author. It is the third official list published and supersedes the check list of 1927 which has been out of print for some time.

The book covers 1,027 trees. It gives their accepted scientific names, their etymology, current synonyms, approved common names, range, bibliography citations, and other information. The list conforms to the International Rules of Botanical Nomenclature; the previous check list to the now obsolete American Code of Nomenclature. It is a work to serve not only the forester, student, and others interested in trees, but also the botanist. Its purpose is to encourage uniform usage of names for trees and its appearance has been awaited to supply a definite need.

—ARTHUR B. MEYER, *Washington, D. C.*

PROCEEDINGS OF THE SIXTH INTERNATIONAL GRASSLAND CONGRESS. *Pennsylvania State College, State College, Pa., Aug. 17-23, 1952. 2 vol., 1801 pp. $15.00.*

Grasslands are becoming more and more important throughout the world as agriculturists strive to meet the ever-increasing demands for food for man and beast, and at the same time safeguard the soil resources from which this food must come.

Testimony to this trend is the record of the Sixth International Grassland Congress, held at Pennsylvania State College in August, 1952.

This meeting of scientists from all parts of the world, for the sole purpose of discussing grass and its management, marked a high point in the development of grassland knowledge. It provided a world-wide summary of the results of research and experience, a sort of climax to all scientific effort in this field.

This was the sixth of a series of international grassland discussions initiated in Europe in 1927 with a meeting in Germany. Subsequent congresses, each on a larger scale than the preceding, were held in Sweden and Denmark in 1930, Switzerland in 1934, Great Britain in 1937, and Netherlands in 1949.

Many readers of this JOURNAL were a part of the international meeting at Penn State. Soil conservation workers were prominent among the more than 1,200 delegates from 49 countries. They contributed liberally to the 37 technical sessions of the 12 sections, where more than 265 scientific papers were presented. By their presence and participation, they emphasized the overriding importance of grass in soil conservation and in permanent, productive land use.

These Proceedings are the record of this meeting. Some idea of the magnitude of the affair is obtained from a few statistics about the books. The two volumes contain 1,801 pages. Sixteen editors signed the foreword, and 320 authors are listed. The index alone fills 29 pages, three columns to the page.

All this adds up to a staggering amount of wordage, but the articles are not verbose. The editors have done a superb job of condensing and clarifying the text. Most of the papers, which required 20 to 30 minutes to present, are reduced to five or six pages of type, many to less.

There is, of course, some duplication in material, but surprisingly little. The programs were well organized in advance, and the subjects carefully planned. All papers were strictly by invitation, and the authors were chosen from all the free nations of the world, each eminently qualified to present his assigned topic.

The result is truly a summary of grassland knowledge as it stands today, organized under the following sectional headings: 1. *Genetics and breeding;* 2. *Improvement and management of pastures, meadows, and turf;* 3. *Improvement and management of range lands;* 4. *Ecology and physiology of grasslands;* 5. *Soil management and fertilization;* 6. *Seed production and distribution;* 7. *Soil and water conservation;* 8. *Harvesting and preservation of forage;* 9. *Use of forage in livestock feeding;* 10. *Machinery;* 11. *Experimental procedure in grassland research;* and 12, *Improvement and management of tropical grasslands.*

The summary nature of the papers sometimes makes for rather dull reading in the topics of the reader's own specialty. Most authors did not attempt to present details of specific researches but emphasized generalizations which would have wide application. Such information is usually familiar to most technical workers in the same field. American readers, however, will find much new material in reports from the other countries, and will be impressed by the similarity of grassland problems in all parts of the world. All will find the papers in related aspects of grassland science rewarding.

The Proceedings should be an invaluable reference for academic use and will provide an excellent introduction to the subject for any one first becoming interested in any phase of grassland agriculture. The literature citations accompanying many of the articles will lead the interested reader to the details of the original

reports.

It is not possible to discuss individual papers here, although many of them are worthy of special note. The Section covering Soil and Water Conservation is especially strong in this respect. It contains an unusually large share of new and vital ideas, supported by research data or accounts of field experience. The plan of having each paper discussed by a worker from a different part of the world than that of the author resulted in a welcome diversity of viewpoint and freshness in the material. Fully half the authors of this section are from nations other than the United States.

The soil and water conservation sessions were organized around three themes: (1) *Aspects of grass in soil and water conservation,* (2) *The role of grass in erosion control,* and (3) *The value of grass in watershed management.* Recent developments in thinking are brought out in discussions of erosion processes and the role of grass cover in protecting soil and preserving water intake capacities; the comparative effects of different kinds of cover on water yields from catchment basins; the relation of fertility to grassland crops and erosion control; the use of grasses for erosion control on non-agricultural areas, and others equally interesting. Several foreign erosion-control and watershed projects are described, particularly examples from New Zealand, South Africa, Hawaii, and Great Britain. These reports mark soil conservation as a new and vigorous science, and show grass to be a major tool in the art of good land use.

A resumé of the entire proceedings is presented in two papers which comprised the summary session of the congress — a sort of summary of summaries, as it were. These 11 pages are probably the most concentrated package of grassland information in print.

The resolution on grassland policy adopted by the congress orients all this information in relation to world problems of land use, production, and conservation. This resolution is reproduced elsewhere in this issue of the JOURNAL, and is worthy of careful deliberation by all conservationists and land program administrators.

—BEN OSBORN, *Midland, Texas*

WATER. *By* CYRIL FOX. *Philosophical Library, Inc., New York. 148 pp. Illustrated. 1953. $8.75.*

This well illustrated book presents an intensely interesting history of one of our most vital resources. It is packed with figures and statistics which are presented in a manner that is interesting and informative to both the professional man and the layman.

Divided into three sections, the author begins with the "Natural History of Water," dealing with the physical and chemical properties, the distribution, and the circulation of water on the earth.

The story of water goes back to the dim ages 1½ billion years ago, or one billion years before the existence of plant or animal life on earth, and is carried through to the use of heavy water or D_2O as a moderator in a present day atomic reaction.

The reader is amazed at the amounts of water present on our earth — 3600 cubic miles in our atmosphere; 315 million cubic miles in our oceans; 800 thousand cubic miles in ice caps and glaciers; plus the water in lakes and marshes, the water held by rocks under the land, the water held in the heated sub-crustal rocks, and the amount held by the soil and plants.

Water known by the ancients as one of the elements was long ago adopted as a standard for many of our measurements, such as volume, specific gravity, viscosity, and specific heat.

As a source of energy, the possibility of converting one-half pint of water into atomic energy, with a yield of power equivalent to that of 600 tons of coal, is mentioned.

In the circulation of water, the author goes beyond the usual description of the hydrologic cycle of precipitation runoff, percolation seepage, evaporation and transpiration and describes ocean currents, air currents, mountains and other natural phenomena, and their effect upon the circulation of waters upon the earth.

Few realize the work done by water upon the surface of the earth. The rock split by a bit of moisture freezing; the transporting power of a flood stream in the Cherrapunji (Assam) where the current was actually turbid with sizable pebbles and capable of moving a 350-ton block of granite for more than 100 yards in a few hours' time; the abrasive power of a muddy stream carving the gorge of the Grand Canyon; and the destructively devastating power of a tidal wave, caused by earthquake or cyclone like the one caused by the Backerjunge cyclone which drove a wall of water ten to forty feet high several miles inland in and around the mouth of the Ganges, destroying everything in its path and taking over 100,000 lives.

The erosion by water, often assisted by man, of our inland areas, the action of waves on our coastline, grinding away of surface by glacial movement, the mud flows, and deltas deposited by rivers have all left their mark on our earth.

All the erosion and solution has not been limited to the earth's surface as evidenced by the vast underground caverns of which Mammoth Cave is a typical example.

Part three, "*The Utilization of Water,*" while not as detailed as the first parts, covers the story of man's dependence on the development of water supplies from the time the Egyptians built a dam across the Nile 3000

years ago, through the more recent developments of the U. S. Bureau of Reclamation and the Tennessee Valley Authority. Water supply, power, contamination, and many of their accompanying problems are illustrated.

Throughout the entire book, the citing of numerous examples, taken from all over the world to illustrate the author's material, makes a fascinating and enjoyable book.

—O. W. CHINN, *Frankfort, Kentucky*

RESOURCES AND THE AMERICAN DREAM, *Including a Theory of the Limit of Growth. By* SAMUEL H. ORDWAY, JR. *Ronald Press Co., New York. 55 pp. 1953. $2.00.*

One advantage of presenting a big idea in such a little book is that anyone who begins to read is likely to finish in one sitting. And this idea deserves a wide reading by thoughtful people.

Mr. Ordway, who is a vice president of the Conservation Foundation, introduces a new argument into the swirling debate over natural resources in which that organization has been a prominent protagonist. It is to the effect that growing consumption of raw materials by an ever-expanding industry is an even greater hazard to the American way of life than pyramiding world populations.

This little essay states the proposition that the American Dream of "an ever higher level of living for more and more people" simply cannot continue indefinitely. Accelerating industrial development, rather than population increase, is the major factor speeding us on to a day of reckoning with a finite supply of material resources.

The Theory of the Limit of Growth is stated in the form of a proposition in logic: " . . . basic resources will come into such short supply that their rising costs will make their use in additional production unprofitable, industrial expansion will cease, and we shall have reached the limit of growth."

This does not mean that the survival of mankind is at stake. "We can control our own destiny if we recognize (and face up to) the probabilities now, and gradually limit consumption to foreseeable replacements of supply." Failure to do this will mean irreparable injury to the social order and could bring an end to our present culture."

This theory doubtless will meet opposition from both sides of the present controversy. It does not satisfy the predictions of doom of the neo-Malthusians. Neither will it quiet the claims of the technologists who maintain that the ingenuity of man will continue to unlock a never-ending supply of raw materials from earth, and sea, and air. But it should provoke new thought on the part of both factions.

While the brevity of the book is an asset, one feels the need of more concrete facts to support and illustrate the new theory. Our resource problems cannot be convincingly argued by abstract reasoning. The author would do the cause of conservation a service by developing this thesis more fully in concrete terms.

—BEN OSBORN, *Midland, Texas*

PLANT DISEASES. *The Yearbook of Agriculture, 1953.* ALFRED STEFFERUD, *editor. U. S. Government Printing Office, Washington, D. C. 940 pp., illus., plus 32 colored plates. $2.50.*

Another handsome volume is added to the Department of Agriculture's unique reference shelf with the publication of the 1953 yearbook on *Plant Diseases.* This is a companion volume to the 1952 number on *Insects,* which it greatly resembles.

Alfred Stefferud, editor of both books, reviews the history of the Yearbook of Agriculture in his preface to the 1953 issue. He traces it back more than a hundred years, to 1849, when the Commissioner of Patents devoted a part of his annual report to agriculture. The publication of an annual yearbook, as such, has been required by act of Congress since 1895.

Since 1936 each volume has been devoted to a single field of agricultural science. This series has developed into one of the most impressive enterprises in group writing of our times. It seeks, with considerable success, to gather into each volume all the information that can be had from all available authorities on the subject in question. Writers of the 1953 yearbook are not all employees of the Department of Agriculture; many are professors in agricultural colleges or associated with other research institutions.

"As a book of science," Editor Stefferud says, "the Yearbook is prepared with no thought of influencing farm policies inside or outside the Department of Agriculture. The aim is to give complete, practical discussions of one topic in clear (but not elementary) language."

Nevertheless, in his foreword, Secretary of Agriculture Benson makes a point of his philosophy of the function of the Department; namely, to emphasize research and education in the solution of agricultural problems, of which plant diseases is one.

"One requirement," he says, "is steady, continuous research in plant industry. . . . "

"Another requirement is that the information be made available to all farmers and everyone else to whom it will be useful. Historically, the function of the Department of Agriculture is to gather information — do research — of value to farmers and to disseminate that

information as widely as possible."

It is not possible to comment on these individual papers here. Conservationists will naturally look with particular interest to *"The effects of soil fertility,"* by George L. McNew of the Boyce Thompson Institute of Plant Research. This meticulous discussion of how fertility levels affect the reactions of different plants to different diseases is packed with factual information. However, it fails to arrive at any generalizations or basic principles.

Its viewpoint is strictly autecological, and may disappoint those who are coming to regard plant diseases as related to the general health of the biotic community. In this respect, the plant pathologists seem to be lagging behind the entomologists, if the two agriculture yearbooks are a true reflection of their thinking.

—Ben Osborn, *Midland, Texas*

Soil Splash by Raindrop Impact

(*Continued from page* 43)

Detachability of soil varies with the permanent characteristics of the soil unit, such as size and shape of particles, and with changing conditions within the same soil, including structure, organic matter content, and influences of plant and animal life. Changing conditions within the same soil, due to ecological processes and the effects of land use and management, seem to cause greater variations in detachability than do the inherent characteristics of the soil.

Detachability rates of medium-textured soils averaged somewhat lower than either fine-textured or coarse-textured soils.

Under field conditions, detachability rates averaged materially higher for cropland soils than for ranges or pasture lands. Tillage contributes to high detachability of cropland soils. Surface crusts formed by lichens, molds, and other low forms of plant life greatly reduce detachability of exposed soils on range lands in depleted condition.

Soil detached and set in motion by raindrops is not necessarily lost from the area, but is available for removal by surface runoff if present. These tests indicated the large erosion hazards inherent in the splash effects of a 2-inch rain of impact equivalent to a hard thundershower.

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life Resources; *Verne E. Davison,* Spartanburg, South Carolina, Regional Biologist for the Soil Conservation Service and a member of the SCSA; *Orrie E. Smith,* Amaranth, Penna., District Game Protector for the Pennsylvania Game Commission; *Dr. Charles R. Hursh,* Asheville, North Carolina, Research Forester for the U. S. Forest Service; *J. Burton Lauckhart,* Seattle, Washington, Chief Game Biologist of the Washington State Game Department; *Carl E. Schwob,* Chevy Chase, Maryland, Sanitary Engineer of the U. S. Public Health Service; *Charles A. Rindt,* Portland, Oregon, Forester with the U. S. Forest Service; *Roger M. Latham,* Harrisburg, Pa., Chief of Wildlife Research, Pennsylvania Game Commission; *Dr. E. Laurence Palmer,* Ithaca, New York, Professor Emeritus at Cornell University and a member of SCSA and *Homer S. Swingle,* Auburn, Alabama, Fish Culturist and Professor of Zoology at Alabama Polytechnic Institute.

Winners in the amateur class are:

Al D. Sutherland, an attorney in Fond du Lac, Wisconsin; *Mrs. E. E. Byerrum,* Warrenville, Illinois, Chairman for the General Federation of Women's Clubs; *Russell Z. Eller,* advertising executive of San Marino, California; *Lawrence F. Blaney,* high school history instructor of Aliquippa, Pennsylvania; *Julian E. Heppler,* business man of Ogden, Utah; *Frank L. Bentz,* 73-year old retired representative of the Maryland Game and Fish Commission; *Mrs. T. M. Francis,* housewife of Birmingham, Alabama; *Francis H. Kortright,* business man of Toronto, Ontaria; *Harry E. Rector,* Vinton, Iowa, insurance man and *C. D. Johnson,* Superintendent of Maintenance of the U. S. Naval Ammunition Depot at McAlester, Oklahoma.

Conservation Cost in Relation to Income Tax Returns

Whether and how costs of applying conservation measures may be deducted in filing income tax returns has been a lively question for several years. It is a question of interest to tax officials and conservationists as well as to farmers and ranchers who are laying out funds for conservation work.

A number of bills on the subject have been introduced in Congress. As yet, however, a commonly accepted fair and equitable treatment of such expenses has apparently not fully evolved.

A Kansas case of considerable interest on this subject was decided during 1953 by the Tax Court of the

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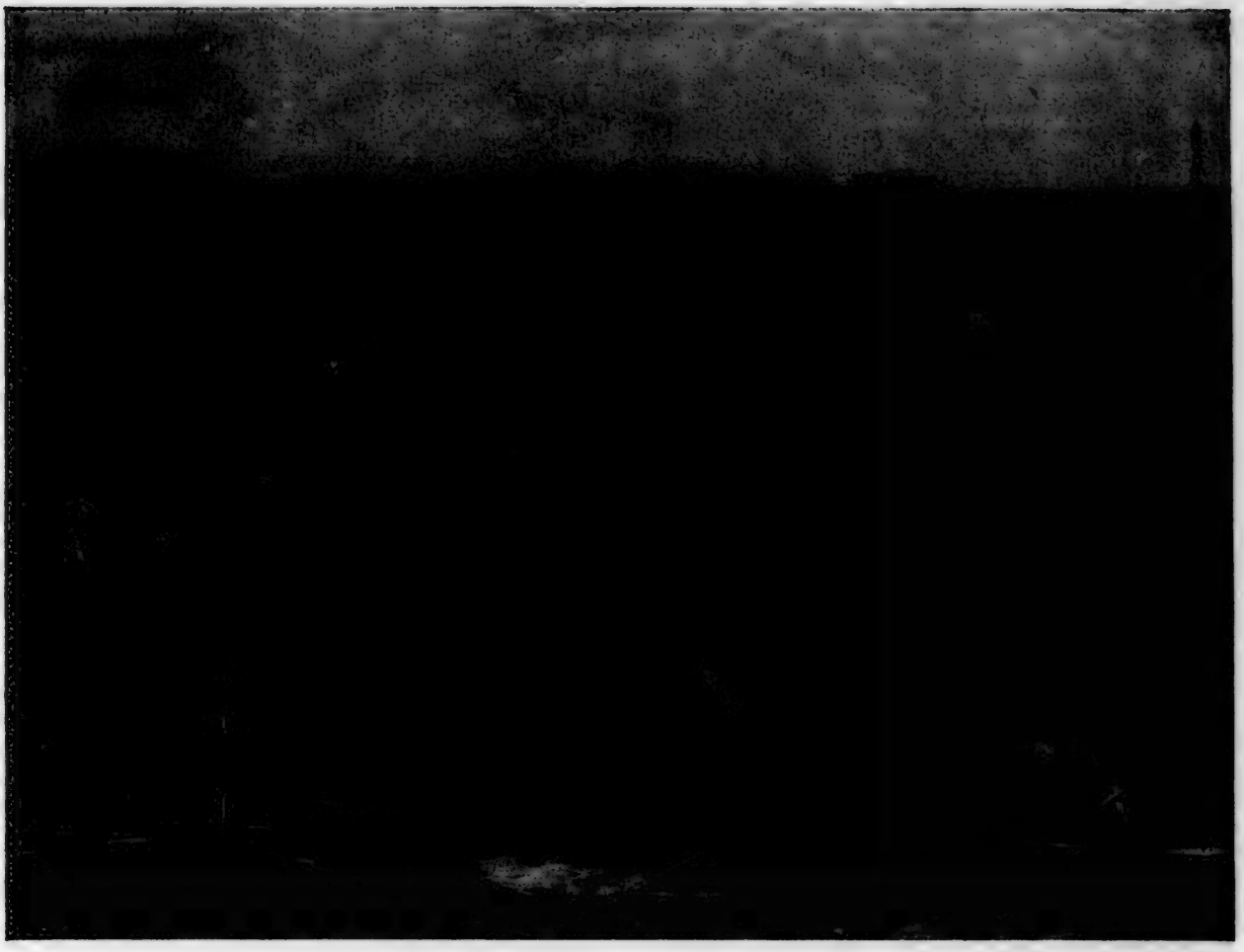

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United States *(20 T.C. No. 132)*. An owner of five farms, rented for the production of income, had been disallowed deduction for the costs of constructing terraces during 1947, 1948 and 1949. The owner petitioned the Court to allow the deductions.

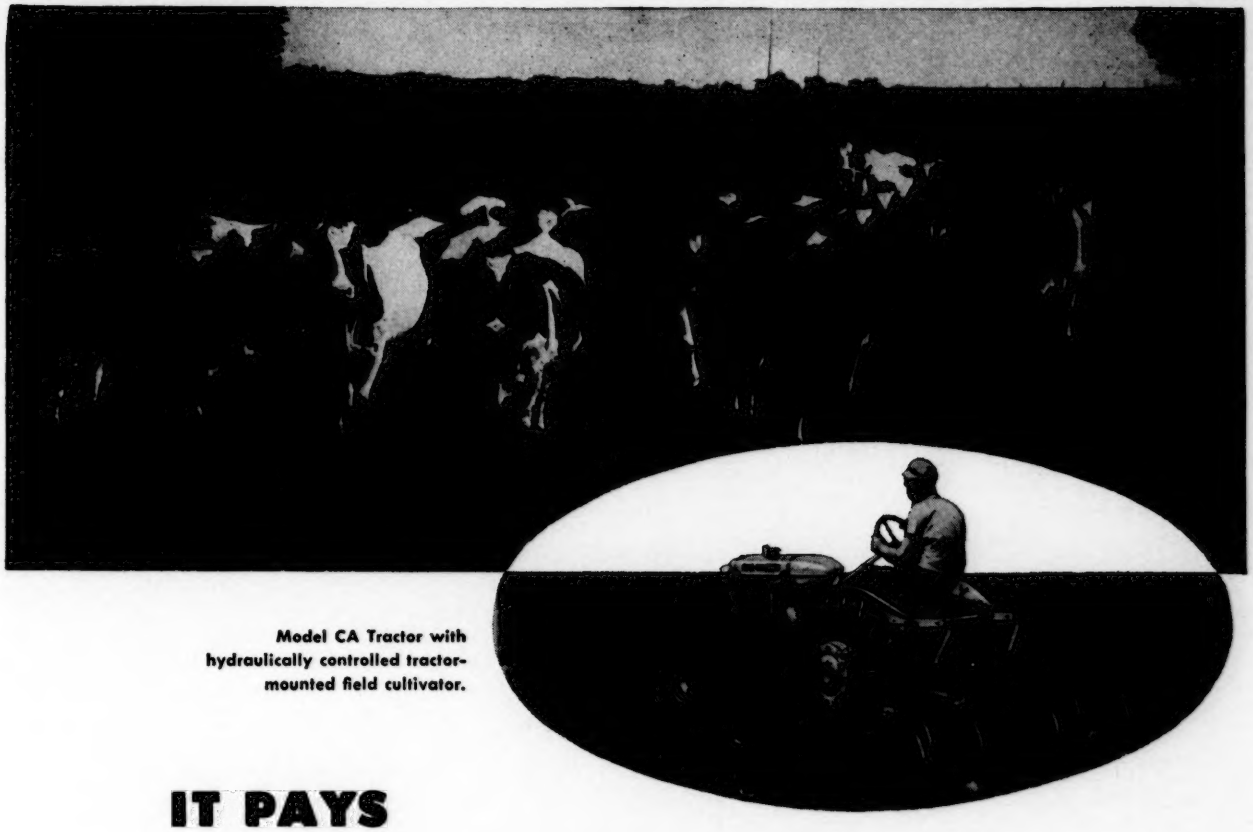
Among the pertinent points in the Court's *"Findings of Facts"* were:

1. The farms were subject to severe and rapid soil erosion before 1947.
2. The farms were not more valuable after the terracing was done. The terracing did not increase the fertility of the soil nor reduce the need for fertilizers nor add to the productivity of the land or make it suitable for new uses.
3. The terracing was done for the purpose of preventing the top soil from being washed away, to reduce water erosion and to retard or stop deterioration of the farm lands.
4. The terraces served these purposes and served to maintain the land in an ordinarily efficient condition for farming.
5. The terracing did not constitute a permanent improvement and the cost of the work was not a capital expenditure but was an ordinary and necessary expense.

The decision allowed the deductions. The opinion summary, as promulgated September 4, 1953, read as follows:

"Petitioner, who owned farms for the production of income which had been under cultivation for many years, sought to check and reduce water erosion and loss of top soil by terracing his farms in accordance with approved specifications. Terraces were made by pushing the earth into ridges following the contours of the land. Nothing new was added to the farms. The purpose was not to change the use of the land, or to prepare it for use, or for new and additional uses, but was to maintain the productivity of the farms in normal and customary operation. Held, the expenditures for farm terracing were essentially for maintenance and conservation and as such are deductible as ordinary and necessary expense under section 23(a) of the Internal Revenue Code, and they were not for permanent improvements within section 24(a)(2)."

T. L. GASTON, *Washington, D. C.*



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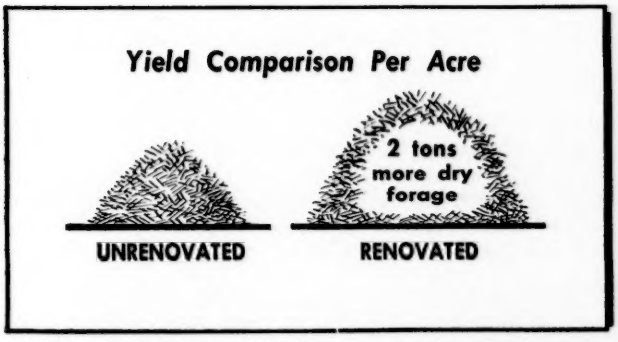

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